~~TOP SECRET~~

CONFIDENTIAL

~~CONFIDENTIAL~~

COPY NO. 112
FOR THE ASSISTANT DIRECTOR
FOR REPORTS AND ESTIMATES

24401

THE USSR PETROLEUM INDUSTRY

CIA HISTORICAL REVIEW PROGRAM
RELEASE IN FULL

ORE 24-49

Published 5 January 1950

DOCUMENT NO. 1
NO CHANGE IN CLASS. ☐
☐ DECLASSIFIED
CLASS. CHANGED TO: TS S C
NEXT REVIEW DATE:
AUTH: HR 70-2
DATE: 30Apr80 REVIEWER: 006514

VOID

10/ /79 1979 365107

CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY

78-1617
Box 35 Fol 2 ~~TOP~~ SECRET
235026

DISSEMINATION NOTICE

1. This copy of this publication is for the information and use of the recipient designated on the front cover and of individuals under the jurisdiction of the recipient's office who require the information for the performance of their official duties. Further dissemination elsewhere in the department to other offices which require the information for the performance of official duties may be authorized by the following:

   a. Special Assistant to the Secretary of State for Research and Intelligence, for the Department of State

   b. Director of Intelligence, GS, USA, for the Department of the Army

   c. Chief, Naval Intelligence, for the Department of the Navy

   d. Director of Intelligence, USAF, for the Department of the Air Force

   e. Director of Security and Intelligence, AEC, for the Atomic Energy Commission

   f. Deputy Director for Intelligence, Joint Staff, for the Joint Staff

   g. Assistant Director for Collection and Dissemination, CIA, for any other Department or Agency

2. This copy may be either retained or destroyed by burning in accordance with applicable security regulations, or returned to the Central Intelligence Agency by arrangement with the Office of Collection and Dissemination, CIA.

DISTRIBUTION:
Office of the President
National Security Council
National Security Resources Board
Department of State
Office of Secretary of Defense
Department of the Army
Department of the Navy
Department of the Air Force
Joint Chiefs of Staff
Atomic Energy Commission
Research and Development Board

THE USSR PETROLEUM INDUSTRY

TABLE OF CONTENTS

SECTION 1. BRIEF

SECTION 2. STUDY

APPENDIXES

TABLES AND CHARTS

APPENDIX A

Agriculture

Transportation Rail

Transportation Motor

USSR Motor Vehicle Inventory and Civilian Motor Transport POL Requirements

Inland Waterways

APPENDIX B

THE USSR PETROLEUM INDUSTRY

SECTION I. BRIEF

1. Statement of Project.

The object of the present study is to evaluate the petroleum industry of the USSR. The following broad subjects are included: (1) Crude Oil Production, (2) Refining Industry, (3) Requirements and Consumption, and (4) Strategic and Military Considerations.

2. Summary and Conclusions.

a. The progress of Soviet crude oil production for 1946 through 1949 has been reported in official yearly rates of percentage increases over the previous year. In order to establish an absolute figure to which these percentage increases could be applied, use was made of a Soviet publication which stated that during the Plan, the average annual increase in oil production will be 3.2 million tons. This fixed the 1945 production at 19.4 million tons. When the official percentage increases are applied to the 1945 base from year to year, the oil production for 1949 is a planned 32.8 million metric tons.

b. An important aspect of petroleum production is the supply of oil field equipment. By 1950, this is planned to be 2.5 times the output in 1940, with a considerable increase in the variety of items manufactured. However, a shortage in fabricated steel and in measuring and control instruments will hinder the expansion of oil equipment production. Soviet trade agreements with Czechoslovakia and Sweden indicate that they are concentrating particularly on oil field pipe and tubing. US shipments of approximately sixty-four million dollars worth of petroleum equipment to the USSR during 1941-1944 was a decisive factor in keeping the Soviet petroleum industry in operation. US shipments from 1945-1948 of about forty-four million dollars worth of equipment further aided the progress of the Soviet oil industry. However, the Western export restrictions instituted in the latter half of 1948 would tend to limit exploration and delay expansion of refinery facilities, particularly for the production of high-octane gasoline.

c. Soviet refining capacity now exceeds crude oil output by an estimated minimum of 13 percent (with 40 percent excess based on all available reports of plant listings). A list showing the location of Soviet refineries and thermal cracking plants, together with their respective capacities, is given in the Appendix. A list of refineries of which there is some evidence but not fully confirmed is also shown. The condensed table below shows plant location by economic region and total crude throughput capacity (principal list) and cracking capacity for each, with the total for the USSR.

The principal equipment shortage for petroleum refining is in specialized types for the production of high-octane gasoline, such as catalytic cracking plants, alkylation and polymerization units.

Note: The intelligence organizations of the Departments of State, Army, Navy, and the Air Force have concurred in this report. It contains information available to CIA as of 25 October 1949.

ECONOMIC REGION: USSR

(All capacity quoted in 1,000 MTY)

Plant Location	*Total Crude Throughput Capacity*	*Cracking Capacity*
Northwest	425	10
South	668	275
Southeast	7,460	2,666
Transcaucasus	17,615	2,517
Volga	1,379	3,703
Central Industrial	2,270	475
Urals	4,225	2,034
Western Siberia	3,234	2,156
Eastern Siberia	56	. .
Far East	1,000	135
Total	38,332	13,971

d. Based on indigenous crude oil production of 32.8 million metric tons in 1949, the available refined products, with the exception of high-octane combat aviation gasoline, will practically meet requirements. The following summary illustrates this:

(Millions of Metric Tons)

	Requirements		*Availability*		*Shortage*	
	Peace	*War*	*Peace*	*War*	*Peace*	*War*
Gasoline	7.5	11.5	7.1	9.6	.4	1.9
Kerosene	5.5	4.8	5.3	4.0	.2	.8
Diesel Oil	4.9	4.9	4.7	4.1	.2	.8
Lubricating Oil	1.9	2.0	1.8	1.6	.1	.4
Residual Fuel Oil	10.1	10.6	9.7	8.9	.4	1.7
Totals	29.9	33.8	28.6	28.2	1.3	5.6

The shortages are based on indigenous production and can be made up by imports and synthetic production with a surplus for peacetime consumption and a relatively small deficit for war.

e. Because adequate specialized equipment, such as catalytic cracking plants, alkylation and polymerization units, is decidedly lacking, production of high-octane combat aviation gasoline, which is so necessary in an air age, lags far behind requirements. From the available information, it appears that the USSR can produce only 35-50 percent of its high octane combat aviation gasoline for full operational requirements. In operations where higher-octane gasoline is not required, 75-85 octane gasoline is available. However, ample jet fuel production facilities are available along with sufficient crude oil supplies to satisfy requirements for air force operations, providing sufficient and satisfactory jet-propelled aircraft are available. Requirements for high-octane aviation gasoline will be reduced to the extent that jet-engined planes replace piston-engined planes.

The estimated Soviet aviation fuel requirement for the first year of operations in war is approximately 2.5 million metric tons of high-octane combat aviation gasoline, of which only approximately 1 million metric tons can be produced. An additional estimated 1,500,000 metric tons of 75-85 octane gasoline, which

has been employed as aviation fuel in the USSR can be made available. This latter grade, however, is not suitable for combat purposes but was generally employed for transport and low-flying ground support and attack.

In the US, blending agents other than those referred to above, such as benzene, toluene, and cumene, which were found so necessary to the US high octane production during World War II, are in short supply in the USSR even for the chemical and explosive industries, and cannot be counted on to augment the supply of high-octane gasoline.

Tetraethyl lead, perhaps the most important component of high-octane gasoline which improves its anti-knock value, is made at the Oka and Kalinin plants in Dzerzhinsk, and the Olginsky plant in Moscow. No other producing areas for this highly critical material are known. Tetraethyl lead is a vital material for the production of combat aviation gasoline because of the small amounts required to produce large increases in the octane rating of the fuel and the efficiency and maneuverability of the plane.

With regard to the whole problem of combat aviation gasoline supply, it is most important that additional detailed information be obtained in the future about the production of tetraethyl lead and the construction and operations of specialized equipment for the production of catalytic cracking base stock, and high octane components such as polymer and alkylate, as well as aromatic hydrocarbons such as benzene and toluene.

f. Ample jet fuel production facilities are available together with sufficient crude oil supplies to satisfy requirements for air force operations, providing there are sufficient and satisfactory jet-propelled aircraft. The availability of jet fuel is limited primarily by composition of the crude oil. Jet fuel consists generally of naphtha, kerosene, and light gas oil, or a mixture of any of them. On the assumption that the naphtha is included in the motor gasoline, and that the jet fuel comprises the total kerosene and light gas oil in the crude, approximately 30 percent of the crude, or about 10 million metric tons per year, may be obtained from 32.8 million metric tons of crude oil. If heavy naphtha is included with this, comprising about 25 percent of the gasoline, an additional 6 percent based on the crude may be obtained, making a total of 36 percent. Thus, with the sacrifice of other products, a maximum production of approximately 12 million metric tons of jet fuel is possible and this should be ample for their needs. Widely scattered storage facilities point to serious attention by the Soviet planners in this direction. Based on present planning, however, high-octane combat aviation gasoline is in short supply and the amount of jet fuel required is relatively small, indicating that the program for jet plane production has only been partly developed.

g. Existing centers of synthetic fuel production, namely, prewar experimental plants in the Kuzbas and near Lake Baikal, have been expanded by the additions of dismantled German plants and the construction of new ones. The center of activity is apparently localized to areas which are distant from petroleum-producing areas but which have suitable coal deposits for use as raw material. In addition, there are other plants outside the USSR, the products of which would be available to them, namely, at Most in Czechoslovakia and in the Soviet Zone of Germany. Also, it is rumored that both Albania and Yugoslavia have plans for development of a synthetic oil industry. The maximum production in 1944 of the six plants in the Sovzone of Germany was over 2 million metric tons, which was reduced by bomb damage and dismantling. Taking into account the present Estonian production of oil from shale and the capacity of the synthetic fuel plants in the Soviet Union, it is estimated that the USSR can produce approximately 1 million tons of synthetic liquid fuels with which to supplement its current availability of POL. The total capacity of the USSR and the satellites is more than double this figure.

It is doubted whether synthetic fuel can be used as combat aviation gasoline because of the large amounts of blending agents and tetraethyl lead necessary to improve it satisfactorily to suit combat standards. Also, employing large quantities of lead in synthetic gasoline would increase engine maintenance

problems. Since the Soviets have very limited refining facilities for the production of catalytic-cracked base stock and alkylates, a shortage of these components for blending combat aviation gasoline has probably resulted. This shortage of blending agents for aviation gasoline may be the reason for the Soviet interest in synthetic fuels when no better product is available.

h. The Soviets will be relatively self-sufficient in 1949 with regard to petroleum products, with the exception of high-octane combat aviation gasoline. However, this has been made possible only by strict control over the supply of petroleum and refined products and adherence to an allocation system which has allowed for careful scheduling of available supply of refined products to meet the essential needs of principal consumers. If judged by Western standards, present Soviet production of refined products is insufficient to meet the increasing requirements of their expanding economy, but severe restrictions on civilian and industrial economy allows a rough balance between supply and minimum requirements.

The requirements of refined products for the principal consumers in 1949, peace and war, are shown below. The data for the individual consumers for peacetime use were obtained by integration of the calculated consumption data of each. These data, considered percentage-wise, check closely the relative distribution or allocation system derived by the British independently. Estimates were made by experts in the various fields of interest as to the quantity of petroleum products needed to operate the economy at the current level of industrial activity. Use was made of such critical indices as the growth of the tractor park, ton-kilometers of freight hauled, activity in the machine tool industry, etc., as an indication of the general industrial growth within the Soviet Union. It is noted that the principal difference between the year 1940, on which the British allocation system was based, and the consumption pattern for 1949 is the emphasis on gasoline and diesel fuel rather than on kerosene, which shows a natural development in the shift from a kerosene economy to a gasoline and diesel economy. Allocations for Soviet industrial economy under possible wartime conditions were derived in the same manner. However, in the latter case the maximum extent to which supply might be curtailed without unduly impairing the effectiveness of the industrial economy to support the military machine in war was balanced against the military requirements as determined by a special study made by the Joint Chiefs of Staff.

Requirements of Refined Products by Principal Consumers

(Millions of Metric Tons)

	1949 Peace	*1949 War*
Agriculture	6.0	5.9
Transportation Rail	3.1	3.0
Transportation Motor	4.4	3.4
Industry	6.7	6.0
Shipping	1.8	.9
Home Use	3.1	1.5
Military	4.8	13.1
Total	29.9	33.8

i. Distribution of Military POL Requirements Assuming War in 1949.

The Soviet transportation system will have the capability of distributing the total military POL requirements amounting to over 12.5 * million metric tons, estimated as needed for one year of military operations: 83 percent or about 10.5 million metric tons will be transported during the year; about 1.6 million metric tons will be stockpiled for the campaigns, and the Black Sea Naval Forces' needs, somewhat under a million metric tons, will not require transportation.

If the entire military requirement is moved over the railroads, the total Soviet rail petroleum distribution capability would be severely strained as there is a requirement of about 28,000 tank cars out of a total of 40,000; and therefore, few tank cars would be available for the movement of civilian and industrial needs during the war. However, it is not likely that tank cars will be used exclusively for the movement of the military supplies, for a considerable amount could be packaged in drums, barrels, or cans, and shipped to des-

* Has been revised to 13.1 million metric tons.

tination in general-purpose freight cars. Moreover, the internal ground and air requirements of motor and aviation gasoline can be moved by tank or general-purpose motor truck when consuming centers are in close proximity to the refineries and the burden on the railroads may be further eased to some extent by the use of water transportation.

j. During World War II, the USSR had no system of supply administration in the field. Generally speaking, existing railway facilities were the determining factor rather than terrain or strategic conditions. Materiel was sent to army depots located at various stations in the rear of the army zone anywhere from 30-60 miles from the front line. In general, while the system was of an elementary character, it proved to be workable and economical. Its essentials would probably be duplicated in a future war, modified, however, by greater allotments of motor vehicles to individual units.

k. The foregoing conclusions are generally summarized in the following tables showing the requirements, available indigenous supply, deficits, imports, and synthetic production for both peace and war, 1949.

1949 PEACE

	Requirements	*Available Indigenous Supply*	*Deficits*	*Imports*	*Synthetic Production*	*Surplus*
Gasoline	7.5	7.1	.4	1.0	.6	1.2
Kerosene	5.5	5.3	.2	.3	.2	.3
Diesel Oil	4.9	4.7	.2	.3	.1	.2
Luboil	1.9	1.8	.1	.1	.1	.1
Fuel Oil	10.1	9.7	.4	.6	. .	.2
Totals	29.9	28.6	1.3	2.3	1.0	2.0

1949 WAR

	Requirements	*Available Indigenous Supply*	*Deficits*	*Maximum Imports*	*Synthetic Production*	*Deficit*
Gasoline	11.5	9.6	1.9	1.5	.6	.2 (Surplus)
Kerosene	4.8	4.0	.8	.5	.2	.1
Diesel Oil	4.9	4.1	.8	.4	.1	.3
Luboil	2.0	1.6	.4	.1	.1	.2
Fuel Oil	10.6	8.9	1.7	.9	.0	.8
Totals	33.8	28.2	5.6	3.4	1.0	1.2

Exclusive of combat aviation gasoline, of which there is a definite shortage, it will be noted from the above that the requirements for other products for both peace and war may be substantially met. This may be accomplished because of adequacy and flexibility of the thermal cracking plants in the production of light products such as gasoline and kerosene for some uses. The indigenous refined products must, however, be supplemented by imports and synthetics. The over-all conclusion is that all requirements can be met for peace or war with respect to all refined petroleum products with the exception of combat aviation gasoline.

l. One of the important phases of the present project is the determination of the impact of Middle East oil and the Soviet capabilities to exploit the same. The most important aspect of Middle East oil to the USSR is the extremely large potential supply of crude oil with an average annual production exceed-

ing that of the USSR and with availability of refining capacity of approximately 80 percent of the USSR. Over and above these factors is the presence of the Abadan refinery of the Middle East, with an annual capacity of approximately 25 million metric tons of petroleum products and currently producing approximately one million metric tons of 100+ octane aviation gasoline. Aside from the large supply of POL products, including jet fuel and residual fuel oils, the acquisition of the Middle East would make it possible for the USSR almost to meet its requirements on a current production basis of combat aviation gasoline for the first year of war. However, a significant limitation to any Soviet designs in the Middle East is the inadequacy of transportation facilities so that the question of production and refining capacity becomes, in effect, secondary. It is estimated that the USSR could transport only one million metric tons per year from the Middle East. If land transportation facilities were continuously and exclusively employed in hauling oil, the theoretical capacity of rail and highway deliveries from Iran to Iraq to Soviet border points and/or Caspian Sea ports is 1,825,000 metric tons per year, but the former figure is considered the probable practical limit of transportation capacity because of the poor condition of the railroads. Even assuming the maximum theoretical carrying capacity of railroads and highways, the existing transportation facilities from the Middle East to the USSR would be sufficient to move only 8 percent of the present Persian Gulf refinery output. Also, the railroads could be relatively easily knocked out of commission by air bombardment because of the many tunnels in the rail net. Any attempt to build a pipeline in order to speed up the flow of Middle East petroleum would be an extremely formidable engineering problem because of the mountainous and difficult terrain.

As a result of the limited supply of combat aviation gasoline in the Soviet Union, it would appear that the Soviets would attempt either to dismantle and transport the basic units for the production of combat aviation gasoline (namely, catalytic cracking, alkylation and polymerization equipment), or in the alternative, to transport by air such critical products as aviation gasoline.

In time of war this would be such a difficult task as to make it wholly impractical.

m. The relative positions of the petroleum industry in the United States and the Soviet Union can be judged largely by production. Of the total petroleum produced in the world, about 59 percent is produced or can be produced within the confines of the United States. On the other hand, Soviet production constitutes only 6.7 percent of the world's total. In terms of actual output, the petroleum production of the United States in 1948 is about 290 million metric tons per year, whereas the Soviet Union has only recently managed to regain its 1940 level of 31 million metric tons per year. While the over-all refining plant of the United States is well balanced with respect to all products, the USSR is deficient in equipment to make combat aviation gasoline. If the past performance of the Soviet oil industry is used as a basis for comparison, the Soviets cannot be expected to make any spectacular improvements in the near future.

SECTION II. STUDY

1. Soviet Crude Oil Production.

Estimates for the base year 1945 showed some divergence and after careful consideration it was concluded that the most reliable method for estimating the current production of crude oil in the USSR was the use of certain releases in the Soviet press. The primary factors used were: (1) the petroleum goal under the current Five-Year Plan; and (2) announcements of progress in the attainment of annual production quotas. The following is a description of the method that was used in estimating crude oil production from 1945 through 1949.

In the postwar period, beginning with the year 1946, the progress of crude oil production has been reported in terms of percentage increases over the previous year. Thus far, the official yearly rate of increase which has prevailed since 1945 has been as follows:

a. Oil production in 1946 increased 12 percent over 1945.[1]

b. Oil production in 1947 increased 19 percent over 1946.[2]

c. Oil production in 1948 increased 13 percent over 1947.[3]

d. BAIBAKOV, Minister of the Soviet oil industry, stated that the goal of the oil industry for 1949 was to increase oil output 12.3 percent over 1948 production.[4]

In order to establish an absolute figure to which the above percentage increases could be applied, use was made of information contained in *Bakinskiy Rabotchiy*, 29 May 1946. This publication stated that during the fourth Five-Year Plan, the average annual increase in oil production will be 3.2 million tons, or a total of 16 million tons for the five years. Since the 1950 goal is 35.4 million tons[1] this implies that the 1945 output is 19.4 million metric tons. If the official percentage increases are applied to this base figure for 1945, the oil production for each succeeding year is as follows:

Year	*Millions of Metric Tons*
1945	19.4
1946	21.7
1947	25.8
1948	29.2
1949	32.8

These estimates are further confirmed, statistically and independently, by reference to a recent Soviet publication.[2] Published by the Soviet Embassy in Washington, D. C., this periodical gave the development and advancement of the petroleum industry in the USSR which was characterized in the following manner:

OIL. INCREASES OVER 1945, WHICH EQUALS 100 PERCENT

Year	*Percentage Increases Over 1945—100 percent*
1946	112
1947	133
1948	151
1949 over 1948	112

If the year 1945 is assigned 19.4 million metric tons derived by the first method, then crude oil production by the above percentage increases is as follows:

[1] IZVESTIYA, 21 January 1947.
[2] IZVESTIYA, 18 January 1948.
[3] IZVESTIYA, 20 January 1949.
[4] PRAVDA, 15 March 1949.

[1] Russian text of the fourth Five-Year Plan, PRAVDA, 21 March 1949.
[2] USSR Information Bulletin, Volume IX, No. 15, 12 August 1949, p. 466.

Year	Percentage Increases Over 1945—100 percent	Production (Millions of Metric Tons)
1945	...	19.4
1946	112	21.7
1947	133	25.8
1948	151	29.2
1949 over 1948	112	32.7

Although the fourth Five-Year Plan envisaged an output of 35.4 million metric tons of crude oil by the end of 1950, Soviet authorities have announced that the goal is now to be reached during the current twelve months. This revision was probably made because of the accelerated tempo of rehabilitation and development during 1946 and 1947, and in view of much greater need arising for the general speed-up of economic expansion in the USSR.

Recent criticisms of the oil industry by Soviet leaders with regard to greater exertions, however, has led some observers of the Soviet oil industry to believe that the revised plan cannot be accomplished and to doubt seriously whether the Soviet oil industry has ever regained its prewar level of output.

Also, it has been assumed by observers of the Soviet economy that the current petroleum output figures do not indicate a rate of progress wholly in line with requirements of the supposed revised plan.

2. Oil Field Equipment.[1]

Since the planned expansion of the petroleum industry depends on the availability of oil field equipment, the USSR has placed heavy emphasis on the rapid development of the Soviet oil field equipment industry in order to lessen Soviet dependence on foreign sources of supply. By 1950, Soviet oil field equipment production is planned to be 2.5 times the output in 1940, with a considerable increase in the variety of items manufactured. An indication of Soviet requirements may be found in the $10 million worth of equipment shipped to the USSR from the US; about half of which was drilling equipment, and the remainder cementing and prospecting equipment. A shortage in fabricated steel and measuring and control instruments will further hinder the expansion of oil equipment production.

The Soviets have improved their postwar supply of oil field equipment by dismantling oil field facilities in the satellites. The difficulties now encountered in the Rumanian oil industry are attributable to the removal of large and diversified types of oil equipment from Rumanian oil fields. In Austria it has been reported that the Soviets in 1945 removed 80 percent of the oil well drilling and field maintenance equipment.

Recent Soviet trade arrangements with Czechoslovakia and Sweden indicate that the Soviets are concentrating particularly on obtaining pipe and tubing for their oil fields. Czechoslovakia is expected to deliver 50,000 tons of oil well tubing by 1952. Sweden is scheduled to deliver 955 drills by the end of 1953, or an average of about 160 drills per annum for a six-year period. A recent report indicates that the Czechs have concluded another trade agreement to deliver more oil field equipment. This Czech-Soviet negotiation, however, may have merely clarified the amount that was to have been delivered under the previous arrangement.

While the Soviet Union is expected to continue importing badly needed oil field equipment, it will probably make a gesture of supplying oil field equipment to Poland. In view of the shortage of equipment in the Soviet Union, it is doubtful if these shipments indicate that the Soviets can adequately assist the satellites in overcoming the critical shortage of their petroleum equipment.

US shipments of approximately $64 million worth of petroleum equipment to the USSR during 1941–1944 was a decisive factor in keeping the Soviet petroleum industry in operation. US shipments from 1945–1948 of some $44 million worth of equipment aided the Soviet oil industry to a point where the present production has reached the 1941 level. A continuation of such oil equipment shipments to the USSR would aid the Soviets in production and increase the rate of expansion.

[1] For a more detailed treatment of the subject see OIR Report No. 4689.3, 14 June 1948.

The present Western embargo on oil field and refinery equipment shipments would not drastically hamper present Soviet oil production. Rather, this action on the part of the West should be (1) instrumental in limiting Soviet oil field exploration and exploitation; (2) delay expansion of refinery facilities principally for the production of high-octane gasoline; and (3) also delay any Soviet schemes of stockpiling strategic quantities of high-octane gasoline and lubricants.

3. Petroleum Refining Industry.

a. Petroleum Refining Equipment.

Soviet refining capacity now exceeds crude oil output by an estimated minimum of 13 percent (with 40 percent excess based on all available reports of plant listings), as shown in Table I. However, the shortage of high-grade refined products, particularly high-octane gasoline, indicates that lack of specialized equipment, such as catalytic cracking plants, alkylation and polymerization units, continues to be the outstanding deficiency in the Soviet petroleum industry. From available information, it appears that the USSR can produce only 35–50 percent of its high-octane combat aviation gasoline requirements for minimum air force operations. In operations where higher-octane gasoline is not required, 75–85 octane gasoline is available. This deficiency in refinery equipment, which retarded the prewar development of the petroleum industry, was aggravated during the war by destruction of plants producing refinery equipment and by conversion of oil equipment plants to armament production.

Recent US restrictions on export of petroleum equipment and products to the USSR have been effective in bringing about this shortage. Another adverse factor is the Soviet limitation in operational efficiency and maintenance caused by a shortage of skilled workers and proper repair facilities.

Construction of sufficient catalytic cracking capacity is in the early stages. This process was introduced only after the end of the war with the shipment of Houdry units under Lend-Lease. Four such units were ordered but orders for two plants were cancelled at the end of the war although the USSR did receive some equipment for these cancelled units. The general lack of technical skill in the Soviet petroleum industry will obviate full utilization of the two completed units, as well as completion of the unfinished units. This shortcoming is evidenced by the Soviet overtures for technical assistance from US companies that took part in installing the plants. Withholding shipments of this type of equipment from the US has not only had the effect of restricting Soviet production of high-octane gasoline, but will probably accentuate the present shortage for several years.

TABLE I

ECONOMIC REGIONS: USSR

(All capacity quoted in 1,000 MTY)

Plant Location	*Total Crude Throughput Capacity*	*Cracking Capacity*
Northwest	425	10
South	668	275
Southeast	7,460	2,666
Transcaucasus	17,615	2,517
Volga	1,379	3,703
Central Industrial	2,270	475
Urals	4,225	2,034
Western Siberia	3,234	2,156
Eastern Siberia	56	...
Far East	1,000	135
	38,332	13,971

b. Refined Products.

(1) *Introduction to Table II.*

In estimating the yield of refined products, the chemical and physical characteristics of the crude oil, relative to the quality and quantity of each of the required products were taken into account. The capabilities of the over-all refining plant, as well as of its individual components, such as general refining and cracking capacities, were also considered. These factors, together with the crude oil production, show the amount of each refined product of a predetermined quality which will be available. The actual weights of each product were simply determined by taking a proportionate amount of each based on the requirement having the above factors in mind.

The volumes of each product were subsequently determined from the weights on the basis of known specific gravities, and the percentages of each calculated.

Table II shows the available refined products, both by weight and volume, based on the estimated indigenous crude oil production of 32.8 million metric tons.

TABLE II

AVAILABLE REFINED PRODUCTS, 1949

	Percentage By Weight	*Products Available (Millions of Metric Tons)*	*Percentage By Volume*
Gasoline	21.6	7.1	25.1
Kerosene	16.1	5.3	17.1
Diesel Oil	14.3	4.7	13.7
Lubricating Oil	5.5	1.8	5.3
Residual Fuel Oil	29.5	9.7	25.8
Total Refined Products	. . .	28.6	. . .
Refining Loss and Fuel	10.0	3.3	10.0
Other Products	3.0	.9	3.0
	100.0	32.8	100.0

(2) *Discussion of Table II.*

As explained above, the weights, volumes, and percentages of each product were determined on a proportionate basis of requirements, taking into consideration the characteristics of the crude oil as well as the necessary quality of the refined products and the capacity and capability of the over-all refining plant to produce the same.

For example, the yield of gasoline, which is the most important product, was determined at 21.6 percent by weight or 25.0 percent by volume of the crude oil. Since this is well within the potential production based on the above considerations, the actual breakdown to produce it would be as follows: the average yield of gasoline from the available cracking stocks, based on the total cracking capacity, taking into account all factors including time cycle efficiency, is 45 percent. The maximum statistical average yield (1944) for the United States which includes unused capacity was 36.5 percent; the used capacity is thus approximately 80 percent. Calculation from these factors as applied to the USSR gives a yield of 29.44 percent of cracked gasoline based on the charging capacity of the over-all cracking plant of 13 million metric tons. The actual weight of cracked gasoline is thus 3.8 million metric tons, i.e., 11.6 percent of the available crude oil. The availability (based on proportional requirement) is 7.1 million metric tons; therefore, the straight run gasoline requirement is 3.3 million metric tons, i.e., 10 percent of the crude oil available, thus making a total of 21.6 percent by weight of gasoline which is the figure cited above. It is to be particularly noted that the yield of cracked gasoline is well within the potential as will be shown later, and the percentage of straight-run gasoline similarly is much lower than that present in the crude. It must be borne in mind, however, that while more gasoline can be produced, the yield is definitely limited in order to obtain a balanced production of gasoline and the other required products as to quantity and quality.

The availability of the other products, namely, kerosene, diesel oil, lubricating oils, and residual fuel oil from the refining viewpoint was also distributed proportionately on the requirement and the amount of crude oil available, having in mind the possible yields of these products from crude oil as determined by the amount available and its characteristics. This applies especially to the production of kerosene and lubricating oils. The limiting factor in the yield of diesel oil is the minimum quality which is acceptable on the one hand and the necessary quality of the residual fuel oil on the other, as these are tied together in the refining process. Refining loss, fuel, and other products, such as wax, asphalt, coke, etc., are based on general practice, taking into account the yields of the other products.

c. Maximum Production Potential of Light Fractions.

(1) *Introduction to Table III.*

In view of the importance of light fractions, particularly gasoline, it has been considered necessary to determine the maximum production potential of light fractions, i.e., gasoline

primarily and kerosene secondarily. This is necessarily founded on the current crude oil production of 32.8 million metric tons, and the over-all cracking and refining plant capacity.

In determining the potential yield of gasoline, careful consideration was given to the characteristics and the quality of the average crude as determined from the weighted properties of the individual crudes from which the quantity of straight run gasoline and kerosene can be directly ascertained. The characteristics of the charging stocks to the cracking plant, and the yields of gasoline obtainable therefrom in plant practice corrected to the time cycle efficiency of the cracking plants, which includes shut-down periods, clean-outs, repairs, etc., were taken into account. The yields of gasoline from cracking were also balanced against the minimum acceptable qualities of the diesel oil and residual fuel oil, all of which are intimately related.

TABLE III

DISTRIBUTION OF PRODUCTS WITH MAXIMUM FEASIBLE PRODUCTION OF GASOLINE

	Millions Metric Tons	*% By Weight*	*% By Volume*
Gasoline	10.8	33	38
Kerosene	3.0	9	9
Diesel Oil	3.3	10	9
Lubricating Oil	2.0	6	6
Residual Fuel Oil	9.2	28	24
Refinery Loss and Fuel	3.6	11	11
Other Products	9	3	3
Totals	32.6	100	100

(2) *Discussion of Table III.*

Since the potential yield of gasoline must be directly derived from and is dependent upon chemical and engineering factors, as well as general refinery practice, it is considered desirable to show the methods by which the results have been obtained. The premise of potential yield is based on maximum gasoline production. This in turn depends on the gasoline content of the crude as well as the cracking plant capacity, and the yields of gasoline obtainable therefrom. Taking into account all operating factors, the yields of light products will be governed by the gasoline and kerosene content of the crude oil as well as the gasoline from cracking. The yield of the latter will depend on requirements and the amount and minimum quality of other products such as diesel oil and residual fuel oil. With a greater cracking capacity than 13 million metric tons it would, of course, be possible to produce even more gasoline from the other products, such as kerosene and diesel oil, and even from the residual fuel oil, i.e., with sufficient cracking capacity all of the crude oil would be converted into gasoline, gas, and coke. Also somewhat more kerosene and less gasoline could be produced if desired as kerosene and the heavy fractions of straight run gasoline are interchangeable within restricted limits. However, this treatment would result either in eliminating the products heavier than gasoline, or in destroying the quality and the usability of products other than gasoline. This approach therefore, would be highly uneconomical and impracticable. Other than for converting the remaining kerosene and diesel oil into gasoline (if required), additional cracking capacity could be profitably employed only if additional crude supplies were available. The above remarks with regard to gasoline production do not apply to combat aviation gasoline, because highly specialized equipment is required for its manufacture.

(3) *Estimation of Maximum Cracked Gasoline.*

With regard to the determination of the potential yield of light products comprising cracked and straight run gasoline, the following data methods were employed, all based on commercial practice. The gasoline yield from the heavy cracking stocks is estimated at 45–60 percent and that from light cracking stocks, 55–70 percent—averaging 62.5 percent. An estimate of the relative amounts of heavy and light stocks is 65 percent and 35 percent respectively. The percentage of cracked gasoline derived from heavy stocks based on total cracking stocks is thus 34.2 percent and that derived from light stocks,

based on total cracking stocks, is 22 percent, making a total percentage yield of gasoline from cracking based on both heavy and light cracking stocks of 56.2 percent.

The over-all time cycle cracking efficiency for US practice is 90 percent maximum allowing for shutdown time, clean-outs, repairs, and equipment replacement. Assuming 80 percent maximum time-cycle cracking efficiency for USSR practice, the over-all average yield of gasoline from the average cracking stock, corrected for time cycle efficiency, is thus 45 percent by volume.

The percentage yield of cracked gasoline by weight was determined by taking into account the relative gravities of gasoline and the charging stock, thus converting volume percentage of 45 to weight percentage of 36.4. The latter figure multiplied by 13 million metric tons cracking capacity gives directly the weight in million metric tons of cracked gasoline, namely, 4.75, which taken against the weight of the crude oil (32.8 million metric tons) is 14.5 percent of cracked gasoline or 19.0 percent by volume.

(4) *Estimation of Potential Straight Run Gasoline in Crude Oil.*

The average percentage of straight run gasoline was determined from analyses of approximately 50 samples of crude oil at various depths taken from the principal fields of the USSR. The weighted average percentage of gasoline was calculated from these analyses with the following results:

TABLE IV
STRAIGHT RUN GASOLINE IN CRUDE OIL

Areas	*Total Crude Production*	*Average % Straight Run Gasoline (Volume)*	*Percentage of Total Straight Run Gasoline*
Caucasus	63%	22	13.85
Volga-Ural	22%	27	5.95
Remaining Areas	15%	12.5	1.87
	100%		21.67

A volume of 21 percent was therefore adopted and this was converted to weight, taking into consideration the relative gravities of the gasoline and crude oil which showed 18.5 straight run gasoline by weight. Therefore, the total gasoline by weight is 14.5 percent cracked gasoline plus 18.5 percent straight run gasoline, or 33 percent. This converted to a volume basis, shows 38 percent, made up of 21 percent straight run gasoline and 17 percent cracked gasoline.

The percentage of potential kerosene by volume may be determined like the straight run gasoline, i.e., from the analysis of the crude oil.

The percentage of lubricating oil shown is based on the requirement; it has been previously determined that this was well within the amount present, as determined by analysis of the crude oil. The percentage of diesel oil and residual fuel oil was found by subtracting the other liquid products produced from total refined products. The quantities obtained are based on the maximum of each of these products which can be produced from the remaining crude oil of minimum acceptable quality. Thus, the potential quantity of gasoline which can be made, especially that obtained by cracking, must be balanced not only against the crude oil or more directly the cracking stocks available, but also the permissible qualities of the diesel oil and/or the residual fuel oil.

d. Aviation Fuels.

(1) *Aviation Gasoline.*

Because adequate equipment, such as catalytic cracking plants, alkylation and polymerization units, is decidedly lacking, production of this critical commodity, which is so necessary in an air age, lags far behind requirements. From available information, it appears that the USSR can produce only 35–50 percent of its high-octane combat aviation gasoline requirements for minimum air force operations. However, ample jet fuel production facilities are available along with sufficient crude oil supplies to satisfy requirements for air force operations, providing there are available sufficient and satisfactory jet-propelled aircraft.

Requirements for high-octane gasoline will be reduced to the extent that jet-engined planes replace piston-engined planes. Table V indicates the present aviation gasoline production within the USSR. In the event of war during the calendar year 1949, the estimated Soviet aviation fuel requirements for the first year of operations are 2,516,310 metric tons of high-octane combat aviation gasoline, and 646,758 metric tons of jet fuel.

In the United States, aviation gasoline generally refers to 95–100+ octane either for combat or commercial transport uses, but in the USSR gasoline of 75–85 octane was widely employed as aviation fuel. The production of this latter grade will, therefore, be included, although it is recognized that for combat purposes, only 95–100+ octane should be considered.

In the United States, aviation gasoline is made generally by blending a catalytic-cracked base material with high octane components, such as polymer and alkylate, and with ethyl fluid. During the war, aromatic hydrocarbons such as benzene, toluene, xylene, and cumene, made largely by catalytic conversion of petroleum hydrocarbons, were also employed as blending agents. With regard to quality, even the gasoline employed for transport planes is superior to 95+ octane rating and generally better than 100+. For combat purposes, 100–130+ octane rating was employed.

In the USSR, however, where the specialized equipment for making 100+ octane combat aviation gasoline, such as catalytic cracking, polymerization, alkylation, etc., is scarce, the situation is quite different. Substantial quantities of relatively low-grade aviation gasoline, i.e., 75–85 octane rating useful for transportation and ground support only, are employed, although their use would not be considered in the United States. To make the latter grade, straight run gasoline with octane rating of 70–78 has been distilled from special crudes, such as Grozny (Malgobek), Baku, and Maykop oilfields. These are compounded on a relatively small scale with higher octane components such as pyrobenzene, alkylated aromatics, and some polymer and alkylate components, etc., as well as on a much larger scale with selected fractions of thermally cracked gasoline and tetraethyl lead to produce the required 75–85 octane product. For the relatively small quantity of 100+ octane gasoline produced, the methods and components referred to above for the US are employed in a limited manner.

High-octane blending agents, such as benzene, toluene, and cumene, which were found so necessary to the US high-octane production during World War II, are in short supply in the USSR even for the chemical and explosives industries and cannot be counted on to augment the supply of high-octane gasoline.

TABLE V (a)

AVIATION GASOLINE PRODUCTION, USSR[1]

(Thousands of Metric Tons per Year)

Regions	*Cracking Capacity*	*High-Octane Production (95–100+ Octane)*
Southeast	2,666	300 (Grozny)
Transcaucasus	2,517	. . .
Volga	3,703	250 (Saratov)
Central Industrial	475	. . .
Urals	2,034	290 (Orsk: 135, Ufa: 155)
Western Siberia	2,156	130 (Guriev)
Far East	135	. . .
	13,686	970

[1] Based on established plant installations capable of producing high-octane combat aviation fuel of 95–100+ octane rating.

TABLE V (b)

PRODUCTION OF 75–85 OCTANE AVIATION GASOLINE, USSR [1]

(Thousands of Metric Tons per Year)

Regions	*% Distribution of USSR Cracking Capacity (13,686)*	*Other Avgas Production (75–85 Octane)*	*Total Avgas Production (75–100+ Octane)*
Southeast	19	291	591
Transcaucasus	18	275	275
Volga	27	413	663
Central Industrial	4	061	061
Urals	15	230	520
Western Siberia	16	245	375
Far East	1	015	015
	100	1,530	2,500

[1] Based on estimate of fuel produced by thermal cracking and selective fractionation of both cracked and selected straight-run distillates, pyrobenzol and probably polymer gasoline and alkylates. USAF consumption estimates of average USSR front-line air force operations during World War II were also considered. While 75–85 octane gasoline is not suitable for use in air-combat operations, it might be employed, in the absence of better quality fuel, for transport and low flying ground support and attack.

(2) *Tetraethyl Lead.*

Tetraethyl lead, perhaps the most important component of high-octane gasoline to improve its anti-knock rating, is made at the Oka and Kalinin plants in Dzerzhinsk and the Olginsky plants in Moscow. No other producing areas for this highly critical material are known.

Various other materials, such as monochlornaphthalene, dibromoethane, and solvents such as benzene and kerosene, as well as a dye, are used in the production of ethyl fluid. The amount of tetraethyl lead in the latter should not be less than 49 percent and varies generally between 62 percent and 63 percent. When two cubic centimeters of ethyl fluid are added to one kilogram of Baku gasoline with an octane number of 69 (C.F.R. method), the resulting product should have an octane number of not less than 85. The specific gravity of the ethyl fluid varies from 1.5 to 1.75 (at 15°C).

Two typical US leaded fuels are shown below as examples:

(1)	Tetraethyl lead	63.3%
	Ethyl bromide	25.75
	Ethyl chloride	8.73
	Dye and other materials	2.23
(2)	Tetraethyl lead	62.0%
	Dibromoethane	26-28
	Kerosene, dye, and other materials	8-10

The last mixture is classed as 1-T in the USSR where a similar mixture is made, classed as grade 1-T.S.

Tetraethyl lead is a vital material for the production of combat aviation gasoline. This is because of the relatively small amount required to produce a very large increase in the octane rating (the amount employed is generally 3 to 6 cc's per gallon, i.e., about 1 to 1.75 parts per 1,000 volume) of the fuel; and correspondingly, the efficiency and maneuverability of the plane.

An important report on the production of the sodium-lead amalgum employed in the manufacture of lead tetraethyl was submitted by ECIA-RT-347-49 dated 21 March 1949.

This report shows the method of production of the amalgam or alloy in sufficient detail to permit calculation of the daily output which was determined at 1,000 liters.

The fused salt installation is located at Igumnovo (Gorki Oblast) which is probably a suburb of Dzerzhinsk. The plant name is Zavodstroy. The process is electrolytic, com-

prising 32 cells with 32 additional cells which it is stated was to have been ready for operation in September 1947. The sodium-lead alloy is converted to lead tetraethyl at the Zavod Yava plant (sometimes spelled Jarva) located near the village of Rolon.

The details of the report, including dimensions of the plant, output, temperatures, and other operating conditions as well as the independent observations of others make it appear to be reliable.

From the data shown including the derived production of 1,000 liters of sodium-lead alloy per day the yield of lead tetraethyl and ethyl fluid may be calculated; i.e., 1,000 liters of the alloy is found to be equivalent to a volume of 2,350 liters lead tetraethyl per day. This can be made up to 3,525 liters or 3,525,000 cc's of ethyl fluid. At the rate of 4 cc per gal. of combat aviation gasoline this is sufficient for the treatment of 875,000 gallons, which is 72 percent of the estimated daily production. At the rate of 6 cc of ethyl fluid per gallon, 48 percent of the production can be treated. With the operation of the additional 32 cells, and assuming sufficient capacity for the conversion of the sodium-lead alloy to lead tetraethyl at the Oka and Kalinin plants at Dzerzhinsk, practically the entire present estimated production of combat aviation gasoline may be treated. This raises the question of the source of supply of sodium-lead alloy at the Olginsky plant in Moscow and whether additional lead tetraethyl over the estimated requirement is produced; also whether it is used in aviation gasoline of lower grade or in motor gasoline.

The reported Soviet practice of employing large quantities of lead in aviation gasoline will lead to an increase of engine maintenance problems. Calculations of the amount of tetraethyl lead per gallon of fuel, based on the Soviet ethyl fluid composition, gives an approximate tetraethyl lead content of 5.5 cc per gallon of fuel. The acceptable US tetraethyl lead content is 4.6 cc per gallon. Service tests conducted in the United States have shown that the use of such quantities of lead will decrease spark plug life, increase crankcase oil sludging, and increase maintenance problems.

With regard to the whole problem of combat aviation gasoline supply, it is most important that detailed information be obtained about the production of tetraethyl lead and the construction and operation of specialized equipment for the production of catalytic-cracked base stock and high-octane components such as polymer and alkylate.

(3) *Jet Fuel.*

Ample jet fuel production facilities are available along with sufficient crude oil supplies to satisfy requirements for air force operations, providing there are sufficient and satisfactory jet-propelled aircraft. The availability of jet fuel is limited primarily by composition of the crude oil. It consists generally of naphtha, kerosene, and light gas oil, or a mixture of any of them. On the assumption that naphtha is included in the motor gasoline and that jet fuel comprises the total kerosene and light gas oil in the crude, a maximum of 31 percent of the crude, or about 10 million metric tons per year, may be obtained from 32.8 million metric tons of crude oil.

If heavy naphtha is included with this, comprising about 25 percent of the gasoline, an additional 6 percent based on the crude may be obtained, making a total of 37 percent. Thus, with the sacrifice of other products, a maximum production of approximately 12 million metric tons of jet fuel is possible and this should be ample for their needs. Widely scattered storage facilities point to serious attention by the Soviet planners in this direction. Based on present planning, however, high-octane combat aviation is in short supply and the amount of jet fuel required is relatively small, indicating that the program for jet plane production has only been partly developed.

e. Synthetic Fuel Industry.

(1) *USSR.*

The Soviet Union is apparently further advanced on synthetic fuel development than had been previously realized. According to the Fourth Five-Year Plan, the production of liquid fuel from coal and shale will reach 900,000 tons,[1] of which 450,000 tons will come from shale,[2] and 450,000 tons will be produced from coal.[3] It is estimated that there are in the Soviet Union 25 synthetic oil plants either

working or in the process of erection, with a potential annual capacity of approximately 2,000,000 tons.[4] This potential includes dismantled German plants which had a total capacity of 1,689,000 tons per annum.[5] It is possible that when the Fourth Five-Year Plan was drawn up, the wholesale dismantling of synthetic oil plants in Germany had not then been contemplated, and in consequence the synthetic fuel plan may be revised in an upward direction.

A high level source (who participated as a scientist in the Soviet synthetic fuel program) states that in 1944 the development was given the status of an independent All-Union Ministry. Equipment and technical data captured from the German synthetic fuel industry are being fully utilized and leading German technicians are being exploited by the Soviet Government. However, these acquisitions have by no means met all the requirements of the Soviet synthetic fuel development. The Soviet program is undoubtedly still handicapped by a lack of modern scientific equipment, repair facilities, and skilled technicians.

Both the hydrogenation and Fischer-Tropsch processes of synthetic fuel production are being developed equally. The main effort has been devoted to developing these two processes with a view to supplementing the short supply of aviation gasoline and lub-oils in the USSR in addition to other petroleum products. The hydrogenation process will produce 70-75 octane gasoline, which can be increased to high-octane gasoline by additions of iso-octanes and tetraethyl lead; Fischer-Tropsch is designed to produce 50-70 octane gasoline, and the octane ratings can be greatly increased by use of improved catalysts. While the hydrogenation process at present produces better gasoline, including aviation gasoline, the Fischer-Tropsch process is receiving attention because of its ability to produce diesel and lubricating oils.

[1] Law of the Fourth Five-Year Plan.

[2] *Soviet News,* 14 June 1946.

[3] From citation in J. I. B. 3/46, December 1947, Voznesenskiy, Report on Fourth Five-Year Plan, para. 22.

[4] J. I. B. 3/77, 28 March 1949.

[5] Ibid.

Since the Soviets have very limited refinery facilities for the production of catalytic-cracked base stock and alkylates, a shortage of these components for blending agents has resulted. This shortage of blending agents for aviation gasoline may also be the reason for the Soviet interest in synthetic fuels when no better product is available.

Existing centers of synthetic fuel product, mainly prewar experimental plants in the Kuzbas and near Lake Baikal, have been expanded by the addition of dismantled German plants and the construction of new ones. The center of activity is apparently localized to areas which are distant from petroleum producing areas but which have suitable coal deposits easily available for use as raw materials. Therefore, the stimulus for the synthetic fuel plant development around the Kuzbas and Transbaikal is to make these regions self-sufficient in fuels and lessen the load on the limited transportation facilities.

Another supplementary source of petroleum available to the Soviet Union is the shale oil produced in Estonia and in the Leningrad Oblast of the USSR. According to the Soviet Estonian Prime Minister, A. Veimer, the production of shale is to rise to 8.4 million tons yearly by 1950 and the production of oil from shale to 1.2 million tons.[1] The Leningrad Oblast is to develop a 1950 production capacity of 3 million tons per annum of shale.[2]

While nothing is known of the shale oil refineries in the Leningrad Oblasts, the present output of the shale oil refineries in Estonia is approximately 1.0 to 1.5 million tons of crude oil.[3]

Taking into account the present Estonian production of oil from shale and the capacity of the synthetic fuel plants in the Soviet

[1] Law of the Fourth Five-Year Plan. Also, A. Veimer, *On Stalin's New Five-Year Plan for the Rehabilitation and Development of the National Economy,* Talin, 1946, p. 14 (cited in ONI Rpt, Serial #6-49, 10 Feb. 49, B-2, "Newsletter from Behind the Iron Curtain," compiled by the Baltic Review, Nos. 95 and 99).

[2] FDB No. 15/49, *The Law of the Five-Year Plan for the Restoration and Development of the National Economy of the USSR, 1946-1950,* 28 Feb. 49.

[3] 00-B-7535-49, 31 Aug. 49 (F-2).

00-B-3178-49, 27 Apr. 49 (F-2).

Union, it is estimated that the USSR can produce approximately 1 million tons of synthetic liquid fuels with which to supplement its current availability of POL.

(2) *Satellites.*

There are only two areas of Eastern Europe outside the USSR where synthetic petroleum products are manufactured. The synthetic gasoline plant at Most in Czechoslovakia was originally designed by the Germans during World War II to produce one million tons of gasoline a year by means of hydrogenation of local coal. Estimates of present output range from 10-50 percent of capacity. The most recent information places it at 20-25 percent.

In the Soviet Zone of Germany there are six important and several smaller synthetic plants. In 1944, the six plants had an aggregate capacity of 2,270,000 metric tons. In 1947, after bomb damage and dismantling, the total capacity was 1,000,000 metric tons. It is estimated that only 60 percent of this capacity is being utilized at this time.

Of the five synthetic plants in Poland (four in the Polish-administered zone of Germany) none is in operation at present. All were damaged during World War II and what was left was for the most part dismantled. However, efforts are being made by the Polish Government to rebuild the hydrogenation plant at Dwary near Oswiencine. It is believed this refinery will not begin operating until 1950. In addition, it has been rumored that both Albania and Yugoslavia have plans for development of a synthetic oil industry.

4. Requirements and Consumption.

a. Methods.

The Soviets will be relatively self-sufficient in 1949 and their position is expected to improve progressively as crude oil production increases and the refining plants are modernized. Thus far, strict control over the supply of petroleum and refined products has prevented shortages which would effectively impair the Soviet plans for economic development. The Soviet Union is continuing to adhere to an allocation system which has allowed for careful scheduling of available supply of refined products to meet the essential needs of principal consumers within the Soviet economy.

It should be emphasized that the Soviet Union is in a position to reduce forcibly its civilian petroleum consumption in a manner inconceivable for application in the United States. If judged by Western standards, present Soviet production of refined products is insufficient to meet the increasing requirements of its expanding economy; but severe restrictions on civilian and industrial consumption allow the Soviet Union to balance approximately its supply and minimal requirements. In this sense, the minimum requirements have been met which are not necessarily the amounts which the Soviet Government would desire.

Such rationing measures serve a dual purpose as prescribed by economic and military considerations. From an economic point of view, strict allocations are designed to meet only the essential industrial needs and to eliminate gradually marginal consumers. From the military viewpoint, control of allocations enables the Soviets to have additional supplies of refined products for their particular needs as well as to stockpile greater quantities.

The various indices of industrial requirements derived in this report are based mainly on the prewar relationship between domestic consumption and the extent to which the principal consumers of petroleum products have been rehabilitated and expanded. The indices established for 1940 and 1944, together with the postwar conditions of the principal consumers, were projected into 1949, as indicative of the probable consumption pattern for that year.

The conclusions in this section of the report are intended to serve primarily as indices of the trend of Soviet postwar petroleum consumption. The methods and assumptions used were largely reflected by the following fundamental factors:

(1) prewar trends in petroleum production and consumption of refined products;
(2) expected growth of the principal consumers;
(3) postwar expansion of the petroleum industry;
(4) continued imports from satellites; and
(5) continued control over allocations.

Moreover, a careful review of all petroleum studies by the State Department, Army, Navy, Air Force, JIC, JCS, JIB (British), ASPB, SDS, SID, etc., were analyzed. Pertinent material from these reports was extracted and taken into account in forming the basis of the Soviet consumption pattern for the years 1940 and 1949.

In an effort to establish a basic structure which would show the distribution of petroleum products among the principal consumers of the Soviet economy in 1940, particular emphasis was given to the British system of proportional allocation. Here, the total petroleum products available to the Soviets in 1940 were categorically allocated according to the main POL (petrol, oil, and lubricants, i.e., refined products in general) consumers. Below is the percentage allocation system as extracted from the British report, JIB, 3/44, TS:

TABLE VI

Consumers	*Percentage Allocations in 1940*
Agriculture	26
Industries	26.3
Railways	10.3
Commercial Vehicles	5.8
Shipping	3.0
Home Lighting & Heating	10.4
Military & Stocks	18.2
	100.0

The 1940 computations were checked with all previous estimates and reports which would bear on the validity of the percentage allocations employed by the British. Therefore, this breakup was included in the 1940 petroleum consumption table since it was found that, by and large, the percentage allocations could be corroborated by most sources on Soviet POL consumption requirements.

In order to have the principal consumers conform to specific areas of interest, the table was rearranged and somewhat modified. Use was made of certain factors found in several of the State Department and SDS documents which avoid the cumbersome breakdown of individual users of automotive vehicles within each main consumer category, i.e., instead of showing the use of such vehicles in industry, a section has been set up to include the entire automotive park in the USSR under Transport Motor. Also, military stocks were excluded from the consumption and requirements for Military. Thus, the following re-distributed allocations have been used in this report:

TABLE VII

Consumers	*Percentage Allocations in 1940*
Agriculture	23
Transportation Rail	12
Transportation Motor	18
Industry	23
Shipping	6
Home Use	10
Military	8
	100

It should be noted that according to the original British table, the total consumption of commercial vehicles and industries is 32.1 percent, whereas the total revised percentages are assigned 40 percent to the two classes. The over-all percentages were also somewhat revised in view of more recent information.

b. Requirements and Consumption of Refined Products, 1940.

In 1940, the USSR produced 31.0 million metric tons of crude oil. Of this total, 26.3 million metric tons of refined products were produced, 4.65 million tons going for refinery loss and other products. This indigenous production was distributed according to the above percentage allocations and translated into the amounts of POL that would be available to each main consumer, e.g., agriculture received 6.0 million metric tons of refined products in 1940, shipping, 1.6 million metric tons, etc. (Table VIII).

Until the outbreak of the war, production surplus over consumption and exports lends credence to probable stockpiling in the USSR. An EUCOM report, Gen. Proj. No. J-89, states that the total stockpiles seem to have been 14-15 million tons before the war, of which the Soviet armed forces alone are said to have stored 7.5 million tons. Nevertheless, the extent of Soviet prewar stockpiling cannot be definitely established and for purposes of this report are not included in the 1940 total. Also,

it can be assumed that POL were mainly designed for consumption by the Soviet armed forces.

c. Requirements and Consumption of Refined Products, 1949; Peace.

The estimates of petroleum consumption by the various classes of consumers in peacetime 1949 was developed by considering the status of petroleum industry, the distribution of refined products, the effect of the war, and the relative position of the Soviet economy in 1949.

gories and the percentage which this bears to the total of refined products; as well as total requirements by the principal consumers.

Estimates were made and checked by specialists in the various fields of interest as to the quantity of petroleum products needed to operate the economy at the current level of industrial activity. Use was made of such critical indices as the growth of the tractor park, ton-kilometers of freight hauled, activity in the machine tool industry, etc., as an indica-

TABLE VIII

REQUIREMENTS OF REFINED PRODUCTS, 1940

(Millions of Metric Tons)

	Gasoline	*Kerosene*	*Diesel Oil*	*Lubricating Oil*	*Total POL*	*Residual Oil*	*Total Requirements by Principal Consumers*	*Percentage Distribution*
Agriculture	1.2[1]	4.1	.2	.4	5.9	. .	5.9	23
Transportation Rail	. .	. .	.01	.5	.5	2.5	3.0	12
Transportation Motor	4.3	. .	. .	.2	4.5	. .	4.5	18
Industry	.3	.3	.9	1.0	2.5	3.5	6.0[2]	23
Shipping	. .	. .	.4	.1	.5	1.1	1.6	6
Home Use	. .	1.7	. .	. .	1.7	1.0	2.7	10
Military	.6	. .	.5	.1	1.2	.9	2.1	8
Total	6.4	6.1	2.0	2.3	16.8	9.0	25.8	100

[1] Includes 1.086 million metric tons of ligroine.

[2] Includes 700,000 metric tons for power stations.

As such, careful analysis was made as to the minimum quantity of petroleum products that would be required to allow for the recovery of various segments of the Soviet economy.

Tables IX and X, which are based on the foregoing considerations, show the estimated requirements of refined products in millions of metric tons for mentioned period. They include the individual products, namely, gasoline, kerosene, diesel oil, lubricating oils, and residual fuel oil, for each of the principal consumers, including Agriculture, Transportation Rail, Transportation Motor, Industry, Shipping and Home Use, as well as for Military. Also shown are the totals of each product in millions of metric tons for all industrial cate-

tion of the general industrial growth within the Soviet Union. These estimates were combined with military requirements, production and imports, and are shown in the tables. Percentage allocations were calculated on the basis of tonnage estimates.

The appendices show in great detail the methods and calculations employed in estimating the POL requirements for the various categories of the industrial economy, and the following are only a brief outline of these methods:

(1) *Agriculture.*

In estimating the requirements for agriculture, a total of 452,000 tractors in full-time use in 1949 is indicated. Despite the fact that

TABLE IX

REQUIREMENTS OF REFINED PRODUCTS, 1949; PEACE

(Millions of Metric Tons)

	Gasoline	Kerosene	Diesel Oil	Lubricating Oil	Total POL	Residual Fuel Oil	Total Requirements by Principal Consumers	Percentage Distribution
Agriculture	1.0	3.0	1.7	.3	6.0	. .	6.0	20
Transportation Rail	. .	. .	. .	.1	.1	3.0 [1]	3.1	10
Transportation Motor	4.0	. .	.2	.2	4.4	. .	4.4	15
Industry [2]	.4	.3	1.0	1.0	2.7	4.0	6.7	23
Shipping [3]	. .	. .	.3	.1	.4	1.4	1.8	6
Home Use	. .	2.1	. .	. .	2.1	1.0	3.1	10
Military	2.1	.1	1.7	.2	4.1	.7	4.8	16
Total	7.5	5.5	4.9	1.9	19.8	10.1	29.9	100

[1] Includes diesel oil.
[2] Includes 1.1 million metric tons consumed by power stations.
[3] Soviet merchant fleet and inland waterways fleet:
a. Diesel oil: 298,686
b. Fuel oil : 1,419,879
c. Luboil : 90,062

TABLE X

MILITARY POL REQUIREMENTS, 1949; PEACE

(Metric Tons)

	Aviation Gasoline	Motor Gasoline	Kerosene (Jet)	Diesel Oil	Lubricating Oil	Residual Fuel Oil	Total
Army		947,700		169,250	107,050		1,224,000
MVD		119,700			11,400		131,100
PVD		62,200			5,900		68,100
Air Forces	412,000	188,000	80,000	33,000	34,000		747,000
Navy		427,230		1,555,424	35,962	653,552	2,672,168
	412,000	1,744,830	80,000	1,757,674	194,312	653,552	4,842,368

the number of tractors in 1949 is less than in 1940, the total horsepower will be greater to the extent that the POL requirements of all kinds will increase from 5.9 million metric tons in 1940 to 6.0 million metric tons in 1949.

(2) *Transportation Rail.*

Although several methods were available for estimating the requirements for railroads, it was concluded that the actual data available for 1940 showing the relative percentages of various fuels employed in terms of thermal units were sufficiently accurate for the present purpose. This resulted in a total fuel consumption of 3.0 million metric tons for the railroads for that year. From all available information, the increased traffic is being largely

met by increased production of coal-burning units although there is a small but steadily growing use of diesel-electric units which appear to be replacing the old oil-burning steam locomotives. Therefore, there appears to be no appreciable change in the oil fuel requirements for the year 1949 although lubricants and grease will increase.

(3) *Transportation Motor.*

With regard to the POL requirements for the civilian motor industry, inventories of the serviceable trucks, motor vehicles, etc., were made and the POL utilization estimated for 1949. Estimated postwar production data (745,000 vehicles, 670,000 trucks) were combined with prewar estimates (110,000 serviceable prewar or lend-lease vehicles). Military inventories of trucks were made independently. POL requirements were then estimated, based on an average utilization of 20,000 miles per vehicle per year for trucks, and 10,000 miles per vehicle per year for passenger cars and a weighted average fuel consumption of 7 miles per gallon for gasoline trucks, 6.4 miles per gallon for diesel trucks, 15 miles per gallon for light passenger cars, and ten miles per gallon for heavy passenger cars. Consumption of lubricating oil and grease was computed on the basis of 5 percent of the gasoline and diesel oil requirements by weight.

(4) *Merchant Shipping.*

The current status of the sea-going merchant fleet under Soviet registry comprises about 522 vessels of 1,000 gross tons and over. Of this total, 201 are oil-burning vessels, consisting of 89 diesel-powered ships and 112 steamships powered by fuel oil.

In the Caspian Sea there are 119 vessels of more than 1,000 gross tons, 92 of them tankers, 27 freighters. Of the tankers 21 are diesel-powered and 71 use fuel oil. Of the freighters, 10 are diesel-powered and 17 use fuel oil.

In estimating fuel consumption actual records were employed, or where not available, consumption rates were based on comparable tonnages. Consumption rates were computed on basis of actual number of ships in each gross tonnage class taking into account days at sea and in port.

(5) *Inland Waterways.*

In order to estimate POL requirements for inland waterways, consideration is given to horsepower inventory of the river fleet, fuel consumption of the inventory by types, annual number of hours of operation of all self-propelled, oil-burning vessels, and fuel consumption of horsepower hours of operation.

It is estimated that the horsepower inventories of the river fleet will be 850,000 at the end of 1949, and 910,000 at the end of 1950. Consideration was taken of the allocation of horsepower inventories to coal- and to oil-burning vessels. One British report states that 75 percent of the vessels consume oil, and reliable data are available on the steam and diesel ratio of 2:1. Based on the assumption of 200 days of operation annually for the average river vessel, and on the utilization time of 37.2 percent, the average number of hours of operation of 1,786 for each self-propelled river boat is derived, and from this the total horsepower hours of operation may be obtained.

On the basis of known factors regarding metric tons of diesel and fuel oil, and the horsepower hours, the total requirements of the river fleet for 1949 have been estimated at approximately 266,000 metric tons. As for the other requirements, references and detailed data are shown in the Appendix.

(6) *Industrial Requirements.*

Requirements for the manufacturing and mining industries, which have been combined under the general heading of "Industrial Requirements," are largely estimated on the basis of the 1937-1940 consumption trend, as well as on the estimated trend of industrial consumption of petroleum products by industry. Also, it has been noted that while the requirements for industry have increased in tonnage during this period, it has consistently accounted for approximately 23 percent of the total annual consumption by all of the major consumer categories considered herein.

It is believed logical to assume that industry generally will keep step in petroleum consumption with agriculture, transportation, and the other categories in the civilian industrial economy in the same manner as has been the case by actual records for 1937-1940.

(7) *Home Use.*

In estimating postwar consumption of kerosene for fuel oil for home use, it was assumed that domestic burning of light oil was used primarily by the urban population for heating purposes and that kerosene is used chiefly by the rural population for lighting and cooking purposes. The increased rate of use of domestic burner oil over kerosene, as well as increased rural electrification, and use of natural gas for cooking, points toward increased urbanization in the USSR. This, together with increased demands for kerosene as jet fuel, or as a component thereof, would indicate a decreasing use of kerosene. The increasing tempo of "cold war" conditions would also be felt in restrictions of consumption of petroleum products for home use; and on this basis, it has been assumed that the consumption in 1949 would be no greater than that allocated in 1940.

(8) *Military Requirements.*

Military requirements for refined petroleum products for the year 1949 have been prepared by the Department of the Navy, ONI, the War Department General Staff, ID, and by the Air Force and Air Intelligence. These data are included in the report and are shown in detail as part of the Appendix.

(9) *Tables.*

All the estimates based upon the above consideration shown in detail in the Appendix were combined with military requirements, production and imports, and are shown in Tables VI to VIII inclusive. Table V showing estimates for 1940 is included for comparison. Percentage allocations are calculated on the basis of tonnage estimates. In general, the consumption pattern for 1949 so derived does not differ much from the base year 1940. The principal difference reflects recent Soviet emphasis on gas and Diesel fuel. Kerosene constituted the bulk of Soviet production before the war. This would indicate that a change in the pattern of petroleum consumption in the USSR is somewhat similar to changes which occurred in the US some years ago, namely, shifting from a kerosene economy to a gasoline and Diesel oil economy.

d. Requirements and Consumption of Refined Products, 1949; War.

Soviet economic activity in the event of war will be significantly greater than under peace conditions, especially in the output of armaments such as tanks, ammunition, guns, and planes, and in the basic industries of steel, petroleum, coal, and non-ferrous metals. To increase further their economic strength the Soviets will undoubtedly curtail the civilian economy to make possible the maximum utilization of economic potential for war. Nevertheless, there probably will not be any drastic change in the present consumption pattern of petroleum products, except Home Use, since such a policy would seriously deteriorate the Soviet position in food and manpower, industry, and transportation, and thereby adversely affect Soviet economic and war potential.

It is not expected that there will be any serious curtailment in agricultural activity, and thereby a cut-back in its present estimated allocation. The industrial war output would be affected at least to the extent that inadequate nourishment would prevent as large an increase in production as might have been possible if there were ample food for all. It is possible, however, for the agricultural consumption of petroleum products in 1949 to drop to the 1940 level without seriously impairing the food supply of the USSR.

Transportation, in the past, the weakest link in the Soviet economy, will have to cope with additional pressure in supplying the front with men and materials, of serving the industrial war economy and, of less importance, maintaining a reduced economy.

If the USSR has full use of its railroad network in a future war, it is believed that there will be no substantial reduction of POL. There may be some curtailment in the use of railroads for civilian purposes, but the Soviets will wish to utilize any such capacity for the industrial war effort. Unless war production is reduced by enemy action or the "scorched-earth" policy is once again applied by the Soviets, the consumption of POL will not be reduced by any significant amount. Military requirements will, of course, be met at all costs. It has been estimated that during World War II, the consumption of refined products by the Soviet Union was less in 1944 than in 1940. However, it must be remembered that by 1944,

the Soviets had lost territory in which a considerable part of their railroad network was located. In a breakdown of the percentages of total fuel used by Transportation Rail in 1944, compared with 1940, Soviet statistics show that the percentage of oil to the total was reduced by approximately 4 percent in 1944. The percentage of coal was also reduced, the slack being taken up by the utilizing of wood as fuel.

It is possible that this performance in case of war could be repeated in 1949 without too great a loss in operating efficiency in certain areas. If this is the case, it is possible that POL consumption by Transportation Rail might be reduced about 3 percent without materially affecting the efficiency of the Soviet railroad system. Therefore, POL consumption would be 3 million metric tons of refined products in 1949 (war).

It is believed that in a war the Soviets would reduce the products consumption of Transportation Motor some 20 percent without seriously affecting their ability to meet minimum needs of industry. In fact, this amount may be easily accounted for through requisition by the military of motor equipment.

It is not expected that industry would receive a POL cut-back in the event of war. Rather, it would be more likely that industry would undergo a shift of emphasis from a situation of peacetime conditions over to definite wartime footing. It is believed, however, that allocation of petroleum products to industry could be dropped back to the 1940 level without endangering the economy of the Soviet Union.

In the event of war, home use would receive the first and most drastic cut-back in the allocation of petroleum products, quite likely to the extent of some 50 percent. Such a drastic cut would still leave the home use consumer group with a supply double to that available to the Soviets during World War II.

The military consumer group would undoubtedly receive the highest priority in meeting its POL requirements in the event of war. To meet the increased requirements of petroleum products for military consumption, allocations to the non-military segment of the Soviet economy would receive a cut-back of the amount ordinarily available under peacetime conditions. Such an attempt was made in this study in estimating how much POL could be taken from the non-military consumers and given to the military without effectively impairing the Soviet industrial economy.

Tables XII, XIII, and XV show the data relative to requirements and availability of

TABLE XI

1949 PEACE

(Millions of Metric Tons)

	Available Indigenous Supply	*Requirements*	*Deficit*	*Imports*[1]	*Synthetic Production*	*Surplus*
Gasoline	7.1	7.5	.4	1.0	.6	1.2
Kerosene	5.3	5.5	.2	.3	.2	.3
Diesel Oil	4.7	4.9	.2	.3	.1	.2
Lubricating Oil	1.8	1.9	.1	.1	.1	.1
Residual Fuel Oil	9.7	10.1	.4	.6		.2
	28.6	29.9	1.3	2.3	1.0	2.0

[1] References:

a. R–185–48, 29 March 1949, JANA Rumania—"Petroleum Production in Rumania."
b. St. Rpt. #11, 31 January 1949, Legation Vienna—"Austrian Oil Production."
c. St. Rpt. #140, 27 September 1949, Legation Budapest—"Economic Report First Six Months 1948."
d. St. Rpt. #155, 12 November 1947, Legation Budapest—"Hungary's Oil Position."
e. R–105–48, 20 March 1947, S–2 Berlin Command—"POL Situation in Soviet Zone."
f. St. Desp. 3237, 24 February 1949, Berlin—"Chemical Production in 1948 and Production Plan in Sov-zone Germany."

POL on the assumption of war in 1949. Table XVI indicates the comparison between peace and war requirements and availability in 1949.

In the former case there is a surplus of two million metric tons while in the case of war the deficit is one million metric tons. This shows that the requirements of crude oil may be substantially met in any event.

TABLE XII

PERCENTAGE DISTRIBUTION OF REFINED PRODUCTS ON TOTAL CRUDE REQUIREMENTS OF 39.3 MILLION METRIC TONS [1]

	Gasoline	*Kerosene*	*Diesel Oil*	*Lubri-cating Oil*	*Residual Fuel Oil*	*Loss and Other Products*	*TOTAL*
Requirements (Millions of Metric Tons)	11.5	4.8	4.9	2.0	10.6		33.8
Percentage Distribution on Total Crude Requirements	29.3	12.2	12.5	5.0	27.0	14.0	100

[1] Wartime requirements of refined products is 33.8 MMT. In order to indicate the total amount of crude oil required to produce the required 33.8 MMT of refined products, "Refinery Loss and Other Products" were taken to be 14 percent. Thus, 33.8 MMT represented 86 percent of the total crude requirements of 39.3 MMT. In turn, the total crude requirement was divided into the refined products requirement to establish the percentage distribution.

TABLE XIII

TABULATION OF REFINED PRODUCTS AVAILABILITY UNDER 1949 WAR CONDITIONS

(Millions of Metric Tons)

	Gasoline	*Kerosene*	*Diesel Oil*	*Luboil*	*Residual Fuel Oil*	*Loss and Other Products*	*TOTAL*
Indigenous Availability [1]	9.6	4.0	4.1	1.6	8.9	4.6	32.8 (Crude)
War Imports [2]	1.5	.5	.4	.1	.9		3.4
Synthetics [3]	.6	.2	.1	.1	. . .		1.0
TOTAL Available for War	11.7	4.7	4.6	1.8	9.8		
Wartime Requirements	11.5	4.8	4.9	2.0	10.6		
Deficit or Surplus	+.2	—.1	—.3	—.2	—.8		

Total Deficit of Refined Products for War: 1.2 Million metric tons.

[1] The percentage distribution of the preceding table was used. These percentages were placed against 32.8 million metric tons of crude oil available to the Soviets in 1949.

[2] CIA estimates.

[3] Products distribution according to German practice and data.

TABLE XIV
REQUIREMENTS OF REFINED PRODUCTS, 1949; WAR
(Millions of Metric Tons)

	Gasoline	*Kerosene*	*Diesel Oil*	*Lubricating Oil*	*TOTAL POL*	*Residual Fuel Oil*	*TOTAL Requirements by Principal Consumers*	*Percentage Distribution*
Agriculture	1.0	2.9	1.7	.3	5.9		5.9	17
Transportation Rail				.1	.1	2.9	3.0	9
Transportation Motor	3.2		.1	.1	3.4		3.4	10
Industry	.4	.2	.9	.9	2.4	3.6	6.0	18
Shipping			.2		.2	.7	.9	3
Home Use		1.1			1.1	.4	1.5	4
Military	6.9	.6	2.0	.6	10.1	3.0	13.1	39
	11.5	4.8	4.9	2.0	23.2	10.6	33.8	100
% of TOTAL	34	14	15	6	69	31	100	

TABLE XV
1949 WAR
(Millions of Metric Tons)

	Available Indigenous Supply	*Requirements*	*Indigenous Deficit*	*Maximum Imports Available from Satellites*	*Synthetic Production*	*Deficit*
Gasoline	9.6	11.5	1.9	1.5	.6	.2 (surplus)
Kerosene	4.0	4.8	.8	.5	.2	.1
Diesel Oil	4.1	4.9	.8	.4	.1	.3
Lubricating Oil	1.6	2.0	.4	.1	.1	.2
Residual Fuel Oil	8.9	10.6	1.7	.9	.0	.8
	28.2	33.8	5.6	3.4	1.0	1.2

TABLE XVI
SUMMATION OF THE PETROLEUM SITUATION
OF THE USSR, 1949; PEACE AND WAR
(Millions of Metric Tons)

	Indigenous Requirements (Refined Products)	*Indigenous Availability (Refined Products)*	*Indigenous Deficit*	*Imports (Peace & War)*	*Synthetic Fuel Production*	*Surplus or Deficit*
Peace	29.9	28.6	1.3	2.3	1.0	2.0 (surplus)
War	33.8	28.2	5.6	3.4	1.0	1.2 (deficit)

APPENDIXES

A. PETROLEUM CONSUMPTION AND REQUIREMENTS OF PRINCIPAL SOVIET CONSUMERS

B. TRANSPORTATION
   1. Distribution of Military POL Consumption Assuming War in 1949
   2. Military Supply Administration

C. SOVIET CAPABILITIES TO EXPLOIT MIDDLE EAST OIL

D. THE RELATIVE POSITION OF THE USSR PETROLEUM INDUSTRY

E. SOVIET CRUDE OIL REFINERIES
   1. List of Crude Oil Refineries in the USSR (confirmed)
   2. Secondary Refinery List (not fully confirmed)

APPENDIX A

PETROLEUM CONSUMPTION AND REQUIREMENTS OF PRINCIPAL SOVIET CONSUMERS

1. Agriculture.

a. USSR Tractor Park.

Tractor numbers in the USSR in 1940 were 523,000.[1] It is estimated that 5,500 tractors were built in 1941,[2] giving the Soviets 528,500 tractors at the time the Nazis invaded the USSR.

It has been reported that 137,000 tractors were lost to the enemy,[3] leaving 391,500 tractors in the hands of the Soviets. It is assumed that 30 percent of the remainder disappeared from use by 1949 because of complete wearing out and cannabalization for spare parts. This would leave a total of 274,000 tractors out of the prewar park operating in 1949.

It is estimated that the USSR seized as war booty, requisitioned, or received as reparations 25,000 tractors by the end of 1948.

In addition, 10,000 tractors were received under Lend-Lease and UNRRA.[4]

Domestic production of tractors was resumed in 1945 with a total of 8,700 manufactured in that year; [2] 14,000 in 1946; [2] 29,300 in 1947; [2] 60,000 in 1948; [5] and a projected total of 78,000 in 1949.[5] However, not all of the 1949 produced tractors will be used in field operations during the entire year and will not consume an annual requirement of petroleum products. It is estimated that the petroleum used by tractors produced in 1949 will be equivalent to the total annual consumption by 31,000 tractors. Thus, a total of 452,000 tractors in full-time use in 1949 is indicated.

b. Horsepower of Tractor Park.

The total horsepower of the 523,000 tractors in 1940 was 10,260,000, or an average of 19.6 horsepower per tractor. The Five Year Plan calls for a total tractor production of 325,000 units during 1946–1950, with a total power amounting to 10.8 million horsepower.[1]

Despite the fact that the number of tractors in 1949 is less than in 1940, the total horsepower will be above prewar, or nearly 11.0 million horsepower in 1949 as compared with nearly 10.3 million horsepower in 1940. The USSR tractor industry is gradually increasing the average horsepower per tractor so that the planned 1946–1950 production of 325,000 tractors will have an average of 33 horsepower per tractor.

c. Petroleum Consumption by Tractors.

In 1940, 523,000 tractors with 10,260,000 horsepower consumed 5.9 million metric tons of petroleum products, or 0.575 ton per horsepower.[2]

Assuming that 80 percent of the total horsepower of the postwar produced tractors was in diesel-consuming tractors, then the follow-

---

[1] *Sotsialisticheskoe Selskoe Khozyaistvo*, 1947, No. 8, p. 11.

[2] OIR Report No. 4704, July 21, 1948, entitled "Draft Power in Soviet Agriculture," Department of State.

[3] *Voennaya Ekonomika SSSR v Period Otechestvennoi Voyni*, by N. Voznesensky Moskva, 1947, p. 160.

[4] See *Twenty-First Report to Congress on Lend-Lease Operations, for the Period Ended September 30, 1945* and also *United States Exports of Domestic and Foreign Merchandise*, Report No. FT 410, Section H, Group 7, 1946 and 1947, Bureau of the Census, Department of Commerce.

[5] CIA estimate.

---

[1] OIR Report No. 4704, July 21, 1948, entitled "Draft Power in Soviet Agriculture," Department of State.

[2] Fuel consumption and breakdown for 1937 and 1940 is estimated in R & A No. 2516, *Domestic Consumption of Petroleum Products in the USSR, 1945–1952*, and cites as references: Wassilief, *Soviet Oil Industry in 1938, in 1939 and in the First Six Months of 1940;* COI (OSS) Report No. 58, "The Effect of Territorial Losses on Russia's Petroleum Position," 20 May 1942 pp. 27–29.

ing breakdown of horsepower in 1949, by diesel-consuming and other fuel consuming tractors, is indicated:

Year	Horsepower of Diesel Consuming Tractors	Horsepower of Tractors Consuming Other Petroleum Products	Total Horse-power
1949	3,546,000	7,417,000	10,963,000

Very little diesel fuel in proportion to other fuels was consumed by Soviet tractors in prewar days. It is safe to assume that the 0.575 metric tons of petroleum consumed per horsepower by the Soviet tractor would also apply to the 20 percent of postwar production in non-diesel tractors as well as in tractors left over from prewar, tractors obtained by requisitions, reparations, and from UNRRA and Lend-Lease.

Both American and Soviet experience has shown that the diesel fuel requirements per horsepower hour on full or near full load is about five-sixths that of kerosene (the common tractor fuel in prewar USSR).[1] This would indicate that the factor 0.575 metric tons of petroleum should be reduced one-sixth or 17 percent in order to arrive at a weight of diesel fuel required per horsepower of diesel tractors. This means 0.477 metric tons of diesel fuel per horsepower.

The following petroleum consumption for 1949 is thus indicated:

	1949
Horsepower of Diesel Consuming Tractors (HP)	3,546,000
Diesel Consumption per Horsepower (metric tons)	0.477
Total Diesel Fuel Required (metric tons)	1,691,000
Horsepower of Tractors Consuming Other Fuels (HP)	7,417,000
Consumption of Other Petroleum per Horsepower (metric tons)	0.575
Total non-Diesel Petroleum Required (metric tons)	4,265,000
Total Horsepower of all Tractors (HP)	10,963,000
Total Petroleum, All Kinds, Required (metric tons)	5,956,000

[1] See "O Tipakh Traktorov v Selskom Khozyaistoe SSSR," by S. P. Matskevich in *Sotsialisticheskoe Selskoe Khozyaistvo*, No. 12, December 1943.

The following breakdown of total petroleum requirements for 1949 is estimated:

	Prewar[1]	*1949*
	(In Millions of Metric Tons)	
Gasoline	1.2	1.0
Kerosene	4.1	3.0
Diesel Oil	0.2	1.7
Lubricating Oil	0.4	0.3
Total	5.9	6.0

TABLE I

USSR TRACTOR PARK IN 1949

(in units of tractors)

	1949[2]
Tractors from prewar production	274,000
Tractors obtained by requisitions, reparations, etc.	25,000
Tractors obtained from UNRRA and Lend-Lease	10,000
Tractors produced in USSR 1945 to 1948, inclusive	112,000
Total tractors produced in 1949	. . . . .
Full-use equivalent of tractors produced in specified year	31,000
Total	452,000

TABLE II

HORSEPOWER OF THE 1949 TRACTOR PARK

	Number of Tractors[3]	*Estimated Average HP per Tractor*[4]	*Total Horsepower*
Tractors from prewar production	274,000	20	5,480,000

[1] Fuel consumption and breakdown for 1937 and 1940 is estimated in R&A No. 2516, *Domestic Consumption of Petroleum Products in the USSR, 1945–1952*, and cites as references: Wassilief, *Soviet Oil Industry in 1938, in 1939, and in the First Six Months of 1940*: COI (OSS) Report No. 58, "The Effect of Territorial Losses on Russia's Petroleum Position," 20 May 1942, pp. 27–29.

[2] See text for explanation of figures.

[3] From Table I.

[4] CIA estimate.

Tractors obtained by requisitions, reparations, etc.	25,000	30	750,000
Tractors obtained from UNRRA and Lend-Lease	10,000	30	300,000
Tractors produced in USSR 1945–1948, inclusive	112,000	31	3,472,000
Full-use equivalent of tractors produced in specified year	31,000	31	961,000
Total	452,000	24.3 [1]	10,963,000

2. Transportation Rail.

No current Soviet data are available on the Soviet railroad requirements for POL. Therefore, these data can only be obtained by means of estimates. There are several methods that might be used in arriving at estimates in railroad POL requirements.

The first way that is suggested is using a firm figure of POL consumption for a prewar year and then increasing this figure in 1949 by the estimated increase in ton-kilometers of freight in that year over the base year. This method is not considered desirable for a number of reasons: (1) a close relationship between ton miles and POL consumption cannot be observed in US transportation statistics; (2) the method presupposes that as ton-kilometers and utilization of equipment increase, the use of oil-burning locomotives will be increased proportionately; and (3) as locomotives are added to inventory, the same relationship between coal and oil-burning locomotives will be maintained. The method has merit only in an estimate of the consumption of lubricating oil and grease which represents only a small percentage of the total consumption of POL.

A second method that might be used is applying experienced POL utilization factors such as tons of POL per ton-kilometer and passenger kilometer of traffic. Such experience factors are not available for the USSR, and although they are available for the United States, the US factors cannot be applied to the USSR, because knowledge of the utilization of oil-burning equipment (i.e., the number of ton-kilometers and passenger kilometers produced by Diesel and oil-burning locomotives as compared with coal-burning locomotives) is not available for the Soviet Union.

The third method, while admittedly one of expediency, appears to be the only one that can be used on the basis of information currently available on Soviet railroads. This method is based on evidence that the use of oil for motive power fuel has not and is not being emphasized on the Soviet railroads. In 1938, a Soviet source stated that up to 90 percent of the total fuel consumed on the railroads was hard mineral fuel.[1] The author goes on to warn that, in the future, the expenditure of mazut fuel will be cut sharply and more and more will the use of coal increase. This is, it is stated, in full compliance with the instructions of the party and of the administration on the conversion to local types of fuel.[2] Moreover, in 1945, it was announced that the use of local fuels and products is a feature of Soviet railroad operations.[3]

Depending upon the availability of local supplies, the railroads of the Soviet Union can burn coal, oil, and wood. The areas in which it is expected that most oil fuel is consumed are the Caucasus and Central Asia. Both coal and oil are used for fuel in the steam locomotives operated on the Caucasus railroads. Coal is principally used in the north and fuel oil in the Transcaucasus. Diesels have also been reported in the Caucasus, and are used

[1] Average horsepower of all tractors.

[1] *Material Supply,* A. V. Naumov, Volume II, Moscow, 1938, page 238.

[2] Op. Cit.

[3] *Stakhanovite Methods for the Economizing of Fuel,* L. G. Murzin and I. P. Feldman, Moscow, 1945, page 3.

because of the difficulties of the water supply and the poor quality of immediately available coal. Possibly from Prokhladnaya south and east in the Turkmen, Uzbek, Kazakh, Tadzhik, and Kirgiz republics south of the 48th parallel are the other areas in which oil-burning rail traction is employed.

In conformity with the Soviet practice of holding to a minimum the quantity of petroleum consumed on the railroads, it seems that the modern type of locomotive, notably the JS passenger locomotive and the FD freight locomotive have not been designed as oil burners, but possibly the Consolidation lend-lease freight locomotive, the L 4-6-2, passenger locomotive, E 0-10-0 freight, the new Pobeda, and the O and Y 0-80 locomotive burn oil when used in the area indicated above.[1]

Information on the total number of kilometers of track on which oil-burning locomotives are used is conflicting. However, it appears that 7,000 kilometers may have been devoted to oil traction in 1940. This would be 7 percent of the 105,000 kilometers of through route in operation in that year. About 6 percent of the 118,000 kilometers of railroad lines planned for 1950 may be used by oil-burning locomotives. Nevertheless, the number of kilometers of track respectively devoted to Diesel and to fuel oil traction is not known, and the amount of traffic planned or carried over oil-burning routes is not available.

Under the circumstances the most desirable method of determining the quantity of oil burned by the railroads consists of relating the percentile consumption of petroleum products to the percentile consumption of coal and wood. The following table shows the percentage relationship in the consumption of the various types of fuel:[2]

[1] JANIS, 41, Section VII, page 8 and page 16; Table VII-7, page 17; Table VII-8. Handbook on USSR Railways Volume III, page 5 and ff. USFA-BWR #52 of 14 Nov. 47.

[2] Embassy Moscow cable, 31 July 1944; Handbook on USSR Railroads. In JIB 3/73 and 3/83, a figure of 93 percent for coal, 6 percent for oil, and 1 percent for wood consumption "before the war" is used. This is related to 1940, but may refer to some other prewar year or even part of a year. Further "93 percent coal" is an ambiguous term since the type of coal is not known. Separating out the lignite and employing an average of about 14,000 BTU for coal to 19,000 BTU for oil, a ration of 1.3 has been used as a conversion factor for oil from hard coal.

TABLE I

PERCENTILE RELATIONSHIP OF RAILROAD FUEL CONSUMPTION

	Year			
	1913	*1933*	*1940*	*1943*
Fuel	*%*	*%*	*%*	*%*
Coal	44 (Coal and Lignite)	74 (Coal and Lignite)	84.6	64.5
Lignite			6.3	17.2
Oil	38	24	8.1	6.8
Wood	18	2	1.0	11.5

The percentages above total 100 percent for each year described and refer to the total caloric fuel consumption on the railroads. In 1940, 93.5 percent of the total coal consumed by all forms of transportation was used by the railroads.[1] The total consumed by transportation was 49 million tons.[2] Therefore, 45.8 million metric tons of coal were consumed by railroads in 1940, and this amounted to 90.9 percent of the total amount of fuel consumed by the railroads. Of this amount, 45.8 million metric tons of coal, 42.6 million metric tons are hard coal types and 3.2 million metric tons are lignite. Converting the lignite into hard coal, the total hard coal would amount to 44 million metric tons.[3] Since 90.9 percent of the total fuel consumed amounted to 44 million metric tons of hard coal, we derive 48.4 million metric tons as the total (100 percent) fuel consumption in 1940 in terms of hard coal. 8.1 percent of this amounts to 3.92 million metric tons of oil expressed in hard coal units. Using 1.3 as a conversion factor from hard coal to oil, a total oil consumption on the railroads of 3.01 million metric tons is obtained.

In 1949, and so far as can be observed for 1950, the increased traffic production is largely being effected by the increased production of coal-burning locomotives although there is a small but growing production of diesel-electric units. The diesel-electric locomotives are be-

[1] Ugol XII, 1940.

[2] SID, USSR, Volume II.

[3] This, most significantly, is the output independently arrived at by JIB, 3/83 of May 49 for the total coal consumption used on the railroads in 1948.

ing used, however, in those areas that currently use oil-burning steam locomotives, and it appears reasonable to assume that the less efficient oil-burning units will be retired as diesel-electric locomotives become available.

The over-all fuel requirements for the railroads, therefore, will be affected only by the small quantity of petroleum products needed for lubricants. A Soviet source states that 28 kilograms of grease are allowed per run of 220 kilometers, and that during a month a locomotive makes no less than 12 trips.[1] Unfortunately, the kind of grease used is not made clear, nor is it made clear whether the 28 kilograms includes lubricants for the cars as well as the locomotives. At 12 trips per month, which appear low, the annual consumption of lubricants would amount to 4.08 metric tons per locomotive. Multiplied by the estimated serviceable locomotive inventory for the year 1949, 104,224 metric tons of lubricants are required.[2]

3. Transportation Motor.

In order to determine the POL requirements for the civilian motor transport industry for any given year, it is necessary to estimate a mid-year serviceable inventory of civilian motor vehicles, and apply to that inventory the estimated utilization of each vehicle and the POL requirement for the estimated utilization.

A mid-1949 serviceable inventory of all trucks[3] was derived by combining postwar production data (745,000 vehicles, 670,500 trucks, see Table I) with an estimated 110,000 serviceable prewar or lend-lease vehicles.[1]

The military inventories of trucks in 1949 has been estimated by the Intelligence Division, Department of the Army. These inventories do not distinguish between serviceable and unserviceable military vehicles, consist entirely of gasoline trucks and do not include any passenger or staff cars. However, from these estimates it is possible to arrive at a mid-year 1949 inventory of 418,607 military gasoline trucks.

The mid-year 1949 inventory of all serviceable trucks, mentioned above, has been converted to an inventory of all trucks on the basis that 65 percent of the total inventory represents serviceable trucks.[2] Therefore the mid-1949 inventory of all trucks amounted to 1,185,380 vehicles. The military inventory for mid-1949 was subtracted from the total inventory at mid-1949 in order to arrive at an estimate of the number of trucks in the civilian economy.[3] This amounted to 498,405 serviceable civilian trucks in mid-1949.

Serviceable passenger car inventories were built up on substantially the same basis as trucks except that no passenger cars were assigned for military use for the reason given. Ten thousand prewar and lend-lease motor cars plus postwar production were estimated to be the serviceable inventory by mid-1949.

Having obtained the average serviceable inventories for the year 1949, POL requirements

---

[1] The Agitator's Notebook #33.

[2] This figure is partially substantiated by US experience. Taking the average consumption per ton and passenger kilometer of grease lubricating oil, and kerosene by the US railroads during the period 1940–46, and applying it to Russian traffic statistics for 1950, 124,327 metric tons of these products will be required to carry the planned traffic. Although the railroad system of the USSR and of the US operate under vastly different conditions, in the matter of lubricants per ton-kilometer and per passenger kilometer, they are roughly comparable.

[3] A reliable estimate of the number of passenger buses is not available. The Soviets plan to produce 425,000 trucks in 1950 and 6,500 buses. The latter is 1.5 percent of the former, and this appears to be a reasonable relationship for the inventory.

[1] Serviceable prewar or lend-lease vehicles in mid-1945 are estimated as follows: 65,000 trucks, 2 tons or less, 10.8 miles per gallon of fuel; 33,000 trucks, 2½ or 3 tons, 7 miles per gallon of fuel; 2,000 diesel trucks, 4 miles per gallon of fuel; 10,000 passenger cars, 10 miles per gallon of fuel. (Based on data taken from D. B. Shimkin, "The Automobile Industry That's Behind the Iron Curtain," as derived from S. A. Akolzin, "Specifications of the Motor-Vehicles of the U.S.S.R.").

[2] The Soviet truck inventory was estimated at 65 percent serviceable at the end of 1947 "Soviet Rolling Stock and Motor Vehicle Industries," ORE 42–48, 1 September 1948. There is no evidence that this percentage of serviceable trucks has changed materially by 1949.

[3] No distinction has been made in the types of trucks held by the military and those in use by the civilian economy, except that no Diesel trucks have been allocated to the military.

TABLE I

POSTWAR PRODUCTION OF MOTOR VEHICLES[1]

Year End	*Total Vehicles (100%)*	*Total Trucks (90%)*	*Light Trucks (45%)*	*Medium Trucks (42%)*	*Diesel Trucks (3%)*	*Total Passenger Cars (10%)*	*Light Passenger Cars (7.5%)*	*Heavy Passenger Cars (2.5%)*
1945	95,000	85,500	42,750	39,900	2,850	4,500	7,125	2,375
1946	130,000	117,000	58,500	54,600	3,900	13,000	9,750	3,250
1947	170,000	153,000	76,500	71,400	5,100	17,000	12,750	4,250
1948	200,000	180,000	90,000	84,000	6,000	20,000	15,000	5,000
1949	300,000	270,000	135,000	126,000	9,000	30,000	22,500	7,500
Total (1945-49)	895,000	805,500	402,750	375,900	26,850	89,500	67,125	22,375
Total (1945-Mid 49)	745,000	670,500	335,250	307,900	22,350	74,500	55,875	18,625

[1] Based on plant by plant analysis made possible through receipt of a number of intelligence reports on individual plants. The most reliable reports appear to be those which have been supplied by means of interrogating German and Japanese prisoners of war.

were estimated on the basis of an average utilization of 20,000 miles per vehicle per year for trucks[1] and 10,000 miles per vehicle per year for passenger cars[2] and a weighted average fuel consumption of 7 miles per gallon for gasoline trucks, 6.4 miles per gallon for diesel trucks, 15 miles per gallon for light passenger cars, and 10 miles per gallon for heavy passenger cars.[1] Consumption of lubricating oil and grease was computed on the basis of 5 percent of the gasoline and diesel oil requirement by weight.[2] See Table III, Appendix B, p. 33 for POL requirements for the year 1949.

[1] The figure of 20,000 miles per truck was derived as follows:

a. The 1950 plan calls for a freight turnover of 25.4 billion ton-kilometers or 69.5 million ton-kilometers per day.

b. Available to carry this freight will be: 391,701 light trucks (50 percent of total civilian truck inventory); 352,534 medium trucks (47 percent of total civilian truck inventory minus 1.3 percent of total vehicle inventory, or 15,665 buses); and 23,502 heavy trucks (3 percent of total civilian truck inventory).

c. Assuming that the light trucks carry an average payload of 1 ton, the medium trucks 2 tons, and the heavy trucks 3 tons, a total of 1,167,275 tons may be carried at one time. To produce 69.5 million ton-kilometers per day, each truck must travel 69,500,000 divided by 1,167,275 or 59.5 kilometers per day. In terms of miles this amounts to 36.9 per day, or 13,469 per year.

d. Assuming loaded haulage to be 2/3 of total travel, the figure of 13,469 miles is increased to 20,206 total miles per truck per year and rounded off to 20,000 miles.

e. This figure is supported by data in "Legkye Metally" No. 7 July 1936, which states that motor vehicles operate on an average 125 kilometers per day for 275 working days in a year. Seventy-one kilometers represent the average daily loaded movement.

[2] No basis for this estimate. It is purely a judgment figure.

[1] Based on data contained in S. A. Akolzin, "Specification of the Motor Vehicles of the U.S.S.R." (Journal of the Auto-Tractor Industry Moscow, 1937, No. 15) and D. B. Shimkin, "The Automobile Industry That's Behind the Iron Curtain." Consumption of Diesel trucks assumed to be same as 5 ton YAZ truck.

[2] These figures are calculated on the basis of 5 percent of gasoline and Diesel oil requirements by weight. This percentage was selected as reasonable in the light of United States experience. For the three years, 1944, 1945, and 1946 United States intercity truck and bus operators filing statistics with the Interstate Commerce Commission reported averages of 4.76 miles per gallon of fuel and 327.2 miles per gallon of lubricating oil. In other words, .21 gallons of fuel were used for every .003 gallons of oil, for a ratio of 70 to 1. In terms of metric tons, with one gallon of gasoline weighing 6.2 pounds and one gallon of lubricating oil 7.5 pounds, the ratio becomes 57.8 to 1. The amount of oil used, therefore represents 1.7 percent of the total weight of the gasoline. Making allowance for grease consumption and the possible less efficient use of lubricants and grease in the U.S.S.R., the use of 5 percent as the basis of calculation seemed a reasonable estimate.

USSR MOTOR VEHICLE INVENTORY AND CIVILIAN MOTOR TRANSPORT POL REQUIREMENTS

TABLE I

USSR MID-YEAR INVENTORY OF SERVICEABLE MOTOR VEHICLES

	1 July 1949
Trucks, 2 tons and under	400,250
Trucks, 2½ and 3 tons	345,900
Diesel Trucks	24,350
Total Serviceable Trucks	770,500
Light Passenger Cars	60,875
Heavy Passenger Cars	23,625
Total Passenger Cars	84,500
Buses [1]	....
Total Serviceable Vehicles	855,000

[1] Included with trucks. Estimated to represent approximately 1.5 percent of total.

TABLE II

USSR MID-YEAR INVENTORY OF CIVILIAN MOTOR VEHICLES

	1 July 1949
Total Trucks	1,185,380
Total Military Trucks	418,602
Total Civilian Trucks	766,778
Civilian Serviceable Trucks	
Gasoline Trucks	474,055
Diesel Trucks	24,350
Total	498,405
Buses [1]	
Serviceable Passenger Cars:	
Light	60,875
Heavy	23,625
Total	84,500

[1] Included with trucks. Estimated to represent approximately 1.5 percent of total.

TABLE III

POL REQUIREMENTS FOR CIVILIAN MOTOR VEHICLES

Gasoline	*1949*
Passenger Cars	
Light [1]	111,401
Heavy [2]	64,969
Total	176,370
Trucks [3]:	
Total	3,730,812
Diesel Oil	
Trucks [4]:	
Total	249,344
Lubricating Oil and Grease [5]	
Total	207,826
Total POL	4,364,352

[1] Computed on basis of average utilization of 10,000 miles per vehicle per annum at 15 miles per gallon.

[2] Computed on basis of average utilization of 10,000 miles per vehicle per annum at 10 miles per gallon.

[3] Computed on basis of average utilization of 20,000 miles per vehicle per annum at weighted average of 7 miles per gallon.

[4] Computed on basis of average utilization of 20,000 miles per vehicle per annum at 6.4 miles per gallon.

[5] Computed on basis of 5 percent of gasoline and diesel oil requirements by weight.

4. Industrial Requirements.

Combining the Manufacturing and Mining Industry, industrial consumption of petroleum products in 1949 is largely estimated on the basis of the 1937–1940 trend of petroleum consumption by industry, on the one hand, and the estimated trend of industrial consumption in the postwar period.

From 1937 to 1940, consumption of petroleum products by industry increased by approximately 19.2 percent, i.e., 4.76 million metric tons in 1937 [1] to 5.68 million metric tons in 1940.[2] While industrial consumption of petroleum products increased in tonnage

[1] *COI (OSS) Report #58,* "The Effect of Territorial Losses on Russia's Petroleum Position," 20 May 1942. This report used the following Soviet publication for its estimate: Planovoye Khozyaistvo, 1937, No. 2, p. 34.

[2] See Table A2, footnote i, R&A No. 2516, 30 April 1945, p. 20.

during the 1937–1940 period, industry consistently accounted for approximately 23 percent of the total annual petroleum consumption when made relative to the other major categories of consumers.

The 1950 goals for plant equipment call for an increase of about 40 percent over the 1940 levels. Since present productivity has not yet reached the 1940 rates in many industries, it is highly unlikely that the Plan will come near attainment, surely not during 1949.

Assessment of the postwar activity level in industry is exceedingly difficult, with only meager and intangible evidence available. Rather than apply an arbitrary increase in the rate of activity in industry to petroleum consumption, it is estimated that petroleum consumption will be approximately the same as in 1940, namely 5.6 million metric tons.

Consumption of roughly 1.1 million tons of oil by Power Stations was incorporated together with Manufacturing and Mining under Industry.[1] In subsequent years, it appears that the relative importance of coal and the generation of electricity increased, while that of fuel oil decreased. As such, the total consumption of petroleum products by the Mining and Manufacturing Industry together with Electric Power Industry is estimated to be 6.7 million metric tons in 1949. Once again, it was found that industry accounted for 23 percent of the total estimated petroleum consumption by the Soviet economy.

5. Shipping.

a. Merchant Shipping.

The current status of the sea-going merchant fleet under Soviet registry comprises about 522 vessels of 1,000 gross tons and over. Of this total, 201 are oil-burning vessels, namely, 89 diesel-powered ships and 112 steamships powered by fuel oil.

In the Caspian Sea there are 119 vessels of more than 1,000 gross tons, 92 of them tankers, 27 freighters. Of the tankers, 21 are diesel-powered and 71 use fuel oil. Of the freighters, 10 are diesel-powered and 17 use fuel oil.

In calculating the estimated consumption and requirement of petroleum products by shipping, use was made of records of daily consumption of fuel oil and diesel oil by tankers and freighters, as recorded for individual Soviet ships. Where no record was available of the consumption record of a specific ship, it was assigned a consumption rate equal to that of a ship of equal tonnage. Consumption was computed on the basis of the actual number of ships in each gross tonnage class, multiplied by the average daily consumption rate of that tonnage class, since consumption rates vary as the tonnage increases.

Days at sea and in port were based on certain actual performance records kept by War Shipping Administration for US freighters, and by the Armed Services Petroleum Board for USNT tankers. An arbitrary reduction of 20 percent in days at sea for freighters, and of 10 percent for tankers was applied to Soviet ships to allow for less efficient operation, especially on loading and discharging, and for poor condition, lack of repair facilities, etc., as compared with US operations.

Days at sea and in port were assumed to be:

(1) Freighters: 160 days at sea; 205 days in port.

(2) Tankers: 215 days at sea; 150 days in port.

The assumption of CIA that a ship in port consumes 20 percent of the amount of fuel consumed at sea was used.

It has been estimated that Soviet shipping requirements in 1949 are as follows:

POL REQUIREMENTS

	Metric Tons
Fuel Oil	
Freighters (deep sea)	734,036
Freighters (Caspian)	422,219
Tankers (deep sea)	50,780
Tankers (Caspian)	65,145
Total fuel oil	1,272,180
Diesel Oil	
Freighters (deep sea)	98,770
Freighters (Caspian)	8,271
Tankers (deep sea)	40,593
Tankers (Caspian)	49,271
Total diesel oil	196,905
Total deep water requirements	924,179
Total Caspian requirements	544,906
Total requirements	1,469,085

[1] JIB 3/73. "The Consumption of Oil in the USSR," January 1949, p. 13.

b. Inland Waterways POL Requirements.

In order to estimate total POL requirements for the inland waterways, it is necessary to obtain information on the horsepower inventory of the river fleet, the composition of this inventory by types of fuel consumed, the annual number of hours of operation of all self-propelled oil-burning vessels, and the fuel consumption per horsepower hour of operation.

Mid-year inventories of serviceable vessels have been used in these computations, since a mid-year inventory represents the average number of vessels available throughout the year. It has been estimated that the horsepower inventory of the river fleet will be 850,000 at the end of 1949 and 910,000 at the end of 1950.[1] Mid-year inventories for these years may be derived by subtracting one-half of the total yearly increment from the end of year inventory for each year, thus giving 820,000 in 1949 and 880,000 in 1950.

No reliable data are available on which can be based allocation of the total horsepower inventory to coal and oil-burning vessels. A British report[2] states that 75 percent of the vessels consume oil and quotes an American report[3] to the effect that the steam-diesel ratio is 2 to 1. A serviceability of 90 percent of the inventory appears reasonable.[1] The total serviceable inventory is therefore estimated as follows:

TABLE I

SERVICEABILITY MID-YEAR INVENTORY OF OIL-BURNING RIVER VESSELS

	1949
Diesel horsepower	182,655
Oil-steam horsepower	370,845
Total (75 percent of entire fleet)	553,500

It is believed that a maximum of 200 days of operation annually is typical for the average river vessel.[2] A Soviet source states that river boats are in motion 37.2 percent of the time.[3] Accordingly, the average number of hours of operation, 1,786 per self-propelled river boat per year is derived.

The horsepower hours of operation by types of oil-burning vessels are therefore as follows:

TABLE II

HORSEPOWER HOURS OF OPERATION

	1949
Diesel oil	326,221,830
Fuel oil	662,329,170

Based on data computed from a British Report,[4] .000312 metric tons of diesel oil are consumed per horsepower by diesel river vessels and .000223 metric tons of fuel oil are consumed per horsepower hour by river vessels burning fuel oil. No firm basis exists for the computation of the consumption of lubricating oil and grease. Although this is not a significant figure in the total Soviet POL consumption, for completeness some allowance

---

[1] The 1941 total inventory of self-propelled river vessels was estimated at 3,600 units and 810,000 horsepower. (Strategic Intelligence Digest, USSR, Volume III, Transportation, pp. 1–4.) An official Soviet source has claimed that 4,000 vessels of all types were destroyed during the war. (River Transport, 31 October 1947.) In order to determine the number of self-propelled river vessels at the end of the war, the prewar proportion of self-propelled vessels to total vessels was applied to the total vessels destroyed during the war and this number was subtracted from the prewar inventory. Based on the prewar average horsepower per vessel, it appears that in 1945, self-propelled vessels had a total of 610,000 horsepower. The current Five Year plan calls for an increase of self-propelled river vessels totaling 300,000 horsepower. On the assumption that there will be an increment of 60,000 horsepower annually, the total horsepower inventory at the end of 1949 will be 850,000 and at the end of 1950, 910,000.

[2] JIB 3/73.

[3] SID, op. cit.

[1] The British Report JIB 3/73 estimates a serviceability of 80 percent, but this does not appear reasonable because 300,000 horsepower of the total of 910,000 horsepower will have been constructed during the preceding five years.

[2] N. N. Baronskiy, *Economic Geography of the USSR*, 8th ed. Moscow, 1947, p. 63. A British Report (JIB 3/73) estimates that the river fleet works an average of 16 hours daily, 6 days a week, 6 months in the year, but this estimate is not supported in any way.

[3] *An Inquiry Into the Economics of Railroad Transportation*, Moscow, 1948.

[4] JIB 3/73.

should probably be made for it. Therefore, 5 percent of the total fuel and diesel oil consumption has been allocated for lubricating oil and grease for the vessels consuming fuel and diesel oil. The same amount of lubricating oil and grease consumed per horsepower hour by fuel and diesel oil vessels has been applied to the horsepower hours produced by vessels burning coal and wood. Accordingly, the lubricating oil and grease consumption of the entire river fleet has been obtained.

The following table presents fuel, diesel and lubricating oil and grease requirements of the river fleet for the year 1949.

TABLE III

POL REQUIREMENTS OF THE RIVER FLEET
(Metric tons)

	1949
Diesel oil	101,781
Fuel oil	147,699
Lubes and grease	16,608
Total	266,088

6. Pipelines.

The POL requirements for pipeline operation is based on the assumption that 50 percent of the pipelines are operated by diesel power at 50 percent capacity 100 percent of the time.

To determine the diesel fuel requirement the factor .000312 tons per horsepower hour[1] was applied to 25 percent of the horsepower hour requirements.

POL REQUIREMENTS, PIPELINES

1949	*Mid-year Mileage*	*Pumping Stations* No.	*Av. Hp.*	*Total Hp.*	*Hphr. (25% Total)*	*Diesel Fuel (Metric Tons)*
Oil	7,430	92.9	895.6	83,204	182,466,346	56,929
Gas	1,192	14.9	2,087.7	31,108	68,220,028	21,285
Total						78,214

7. Home Use Requirements.

In estimating the postwar consumption of kerosene and fuel oil by Home Use, it was assumed that domestic burning or light oil is used principally by the urban population for heating purposes and that kerosene was used chiefly by the rural population for lighting and cooking purposes.

Home Use consumption of light fuel oil increased more rapidly than consumption of kerosene in the postwar period, reflecting continuation of the trend toward greater urbanization in the Soviet Union. Also, more extensive use of kerosene is likely to be offset by increased rural electrification and natural gas will probably be more widely used in the cities than before the war. Nevertheless, rural electrification and natural gas is expected to eliminate the consideration of kerosene. In view of the Soviet policy to maintain a relatively high state of military preparedness, it is believed that the Soviet Government will expend further effort in restricting civilian home consumption of kerosene and fuel oil. Therefore, consumption in 1949 will be probably no greater than the total allocated in 1940, namely, 2.7 million metric tons;[1] a slightly greater availability of kerosene and fuel oil to Home Use has been shown to compensate to some degree the trend toward greater urbanization in the USSR.

8. Military Requirements of Refined Products.

Soviet military requirements of refined products for the period being considered have been prepared by the Department of the Navy, ONI, and the Intelligence Division, War Department General Staff.

[1] JIB 3/73.

[1] Prewar consumption:
1937—2.3 million metric tons (10.8 percent of total consumption)
1940—2.7 million metric tons (9.8 percent of total consumption)
Ref. CDI (OSS) Report #58, *The Effect of Territorial Losses on Russia's Petroleum Position*, 20 May 1942, pp. 28–34, 37–41.

APPENDIX B

TRANSPORTATION

1. Distribution of Military POL Consumption Assuming War in 1949.

a. Problem.

To estimate the capabilities of the USSR transportation system to distribute the Soviet military POL requirements in the event of war during 1949 within the country and to the borders, and to estimate the amount of POL that will be in transit in order to insure sufficient supplies where and when needed.

b. Assumptions.

(1) The total military POL requirements are those set out specifically in JIG 278/6–12,675,990 metric tons.[1]

(2) The Soviets will have stocked in the jump-off area sufficient POL to last for the duration of the ground and air campaigns including the periods of combat and inactivity (1,316,150 metric tons); the Black Sea Naval Forces' requirement will not need transportation (824,090 metric tons); the distribution of POL will include the ground and air requirements for the occupation and for forces within the USSR and the entire naval requirement needing transportation (10,535,750 metric tons).

(3) The total military requirement will be supplied from production within the USSR.

(4) The movement of the military POL requirement will be given highest priority on the USSR transportation system.

(5) The average loaded petroleum tank car and general purpose freight car on the Soviet railroads will produce approximately 3,000 ton miles per day.

[1] The Soviet military POL requirements have been revised to total 13.1 MMT. For the purposes of the present report, however, the original figure of 12.6 MMT requirements has been retained which would otherwise require recalculations throughout the report. The slight difference between the two figures does not in any way alter the conclusions arrived at in the study.

c. Discussion.

(1) Under the assumption that the movement of the military POL requirement would be given highest priority on the USSR transportation system, railroad transportation of POL in tank cars would be used, whenever it is economical, for all products except lubricants. Lubricants would be packaged in drums, barrels, or cans at the refineries and shipped to consuming areas in general purpose freight cars. If the entire military POL requirement were shipped on the railroads, this movement would require the use of a total of 28,320 tank cars for aviation gasoline, motor gasoline, Diesel, fuel and jet oils, and 1,363 general purpose cars for lubricants.

(2) Inasmuch as there are currently only about 40,000 serviceable tank cars in the USSR, the movement of the military POL requirement would demand a substantial part of the total serviceable tank car supply, but the inventory of general purpose freight cars is so large that the military requirement for this type of car is almost insignificant. Accordingly, if the entire military POL requirement is distributed on the railroads, the Soviet tank car position would be severely strained and leave an inadequate number of tank cars for the distribution of civilian and industrial POL needs in the event of war. It is not likely, however, that the total military requirement of aviation and motor gasoline, Diesel, jet and fuel oils would be moved exclusively by tank cars or that the military POL requirement would be hauled entirely on the railroads.

(3) Some of the military POL requirements in addition to lubricants can be packaged in drums, barrels, or cans at the refineries and shipped to consuming areas also in general purpose freight cars. This would be most feasible in connection with short hauls of motor gasoline. Moreover, it is entirely possible

that the internal ground and air requirements of motor and aviation will be moved by tank or general purpose motor trucks when the consuming centers are in close proximity to refineries. Water transportation can also be used to fulfill part of the Baltic and Arctic Naval and Merchant Marine requirement, and this type of transportation can also be used for the purpose of reducing the rail haul by transporting POL from the Caucasus by way of the Caspian Sea and Volga River or the Black Sea to rail transshipment points nearer the consuming areas. Pipelines, particularly the one extending from Armavir to Tradovaya, can be used to reduce the requirement for transportation by railroad tank car (Appendix A).

(4) Based on the speed of railroad tank car movement, a total of 239,000 metric tons of POL will have to be in transit on the railroads at all times during the year in order to insure that supplies will be available when and where needed. Because other forms of surface transportation are generally slower than railroad transportation, a considerably larger amount of POL would have to be in transit if other forms of transportation, in addition to the railroads, are used in the distribution of POL (Appendix B).

d. Conclusion.

(1) The USSR transportation system could distribute the Soviet military POL requirements in the event of war during 1949.

(2) The amount of POL that would have to be in transit in order to insure that sufficient military supplies are available where and when needed is a minimum of 239,000 metric tons.

2. Military Supply Administration.

a. Supply System and Packaging.

In the late war, the Russians followed no set system of supply administration in the field. The distances between railroad and army dumps and thence to divisional dumps were governed less by terrain or strategic conditions than by existing railway facilities. Cases occurred where horse-drawn supply columns had to lift supplies from the railhead and carry them 60 miles to Army dumps, but the average distance was about 25 miles. The tendency was to assemble large numbers of small dumps within Army or Divisional areas rather than build up large central dumps. Almost all dumps were small by western standards. Consequently, in spite of the improvised nature of the supply system, wastage from all causes, and particularly from enemy action, was probably relatively small. Packaging received through Lend-Lease, particularly standard steel barrels, was undoubtedly widely used and re-used. The USSR also received under Lend-Lease 120 tank cars and a number of tank trucks.

The following is an extract from Strategic Intelligence Digest, USSR, Chapter 6, Armed Forces, ID, May 1948, and indicates the best information available on the POL supply system employed by the Soviet Armed Forces:

"During World War II, supply responsibility and the system of supply in the Zone of the Interior were the same as they are today. Supply units and organizations in the combat zone was organized as follows:

"Factories or central storage depots supplying combat echelons shipped equipment and supplies to front (army group) depots, which were normally located in the vicinity of railheads behind the rear boundary of the command. These depots were large semi-permanent installations containing several days' supply.

"From front depots, materiel was sent to army field depots located at various stations in the rear of the army zone anywhere from 30 to 60 miles from the front line. The army depots usually maintained stocks of 1 unit of fire, 3 to 4 rations, and 2 refills of fuel and lubricants for the army, although reserves were increased if protracted offensive operations were in prospect.

"Rifle corps during the war had very little supply responsibility. They maintained no supply depots. Aside from the supply of corps headquarters and corps troops, supply personnel had only planning and supervisory functions.

"Ammunition, fuel, food, and fodder were forwarded to rifle division supply points by army transport columns. Other supplies were drawn at army depots by division transport columns. Normally division transport carried ammunition, fuel, food, and fodder to regimental supply points, although horse-drawn columns of rifle regiments sometimes obtained the latter three items at division supply points.

"Unlike rifle corps, wartime tank and mechanized corps maintained supply dumps. These were normally located between crops and brigade or regi-

mental rear boundaries and were supplied by their own motor vehicles from army field depots.

"Subordinate units were supplied by motor vehicles of the tank or mechanized corps. In a rapidly developing situation, army transportation reinforced unit transportation.

"The combat supply system of the Soviets during World War II was efficient and economical. Its essentials would probably be duplicated in a future war. A distant extension of the theater of operations, however, would probably result in the establishment of communications zone between the zone of interior and the combat zone. Moreover, now that allotments of motor vehicles to units have been greatly increased, the system of higher unit distribution of supplies and equipment may be amended to allow for units below army transporting forward their own supply requirements."

APPENDIX B (1)

SOVIET CAPABILITIES TO TRANSPORT MILITARY POL REQUIREMENTS IN THE EVENT OF WAR

1. Total Transportation Requirement.

The total POL requirement assumed to be stockpiled and requiring transportation divided by categories of products is tabulated below:

b. The total number of general purpose freight cars needed for the transportation of 746,383,500 ton miles of lubricants is 1,363.

c. Transportation of POL supplies for the occupation forces and the Navy will require

TYPE OF PRODUCT
(Thousands of Metric Tons)

	Gasoline	*Diesel*	*Lubes*	*Av. Gas*	*Fuel Oil*	*Jet*	*Total*
Stockpiled	650	334	97	206	None	29	1,316
Requiring Transportation	3,387	1,464	467	2,310	2,290	618	10,536
Black Sea Naval Requirements *	16	58	8	. . .	742	. . .	824

* Not considered as requiring transportation for purposes of this study as it will be filled by refineries along coast and only ship-shore transportation will be needed.

2. Railroad Transportation.

a. If the railroads were used exclusively for the transportation of the total military POL requirement, this movement would amount to a total of 16,249,063,500 ton miles or six percent of the total Soviet railroad traffic in 1948. The Soviets would use tank cars to the greatest extent possible for all products except lubricants. The total number of serviceable tank cars needed to carry the 15,502,680,000 ton miles representing all products except lubricants is as follows:

Product	*Number of Tank Cars*	*Percent of Total*
Gasoline	6,990	25
Diesel	3,375	12
Av. Gas	8,074	28
Fuel Oil	8,934	32
Jet	947	3
Total	28,320	100

18,620 tank cars or 66 percent of the total. By services, these are divided as follows:

Service	*No. of Cars*	*Percent of Total*
Ground Force	2,983	16
Air Force	5,379	29
Navy	10,258	55

d. The transportation problem is clearly high-lighted by the following table which shows that of the total of 18,620 tank cars needed to supply the occupation forces and the Navy, a total of 13,023 tank cars or 70 percent will be needed to supply the forces in the Far East.

DESTINATION OF SHIPMENTS	USING SERVICE *Ground*	*Air*	*Navy*
	(Tank Cars Needed)		
Western Europe	1,591	1,235	. .
Middle East	72	62	. .
Far East	1,320	4,082	. . .
Black Sea	. . .	. . .	0
Baltic	. . .	. . .	2,217
Arctic	. . .	. . .	420
Pacific	. . .	. . .	7,621

[p. 40 blank]

e. Zone of the Interior ground and air forces will require 9,700 tank cars for the transportation of POL or 34 percent of the total number. Here again the substantial demands on transportation for supplying the Far East are brought clearly to light, for 4,420 tank cars or 46 percent of the total needed to supply Zone of the Interior forces will have to be engaged in transportation to the Far Eastern region.

f. Method Used in Estimating Railroad Transportation Requirements.

(1) Annex "A" to this appendix sets out in detail the POL requirements by types of products of each user, the economic region or regions from which the POL will have to be transported, the total number of ton miles and cars required for each movement, and the total transport burden measured in ton miles and cars. Annex "B" is a map which presents graphically the POL requirements by campaigns and economic regions.

(2) The ground force occupation needs were computed on the basis of the number of refills estimated in JIG 278/6. Air force occupation needs and ground and air force needs within the Zone of Interior, were furnished by the Joint Intelligence Group. The breakdown of Naval requirements by areas was prepared by the Ad Hoc Petroleum Distribution Committee.

(3) The location of refinery production by economic regions was furnished by the CIA.

(4) In computing the transport burden, the needs of each user for POL were filled from available production closest to the user. Railroad mileages for each shipment were taken from the Soviet Railroad Timetable, except in cases where the locations of production or consumption were not definitely established. In such cases an average railroad mileage figure was used.

(5) In order to determine the total number of tank cars the total annual transportation requirement measured in ton miles was divided by one-half the loaded ton miles that can be produced annually by each serviceable tank car. It is believed that the average capacity of a tank car carrying petroleum products in the USSR is approximately 16 tons and that the average car miles per car day will be about 186 miles. The product of tons and car miles is 2,976 or 3,000 ton miles per loaded tank car per day. Inasmuch as the empty tank car movement will approximately equal the loaded movement, the average effective ton miles produced per tank car is 1,500 ton miles. The annual effective ton miles produced per tank car will be 365 times the effective daily movement or 547,500 ton miles produced per tank car yearly. The annual ton-mile requirement for the distribution of POL amounting to 15,502,680,000 ton miles was then to obtain the total tank car requirement of 28,320 cars. The same process was repeated to obtain the requirement of 1,363 general-purpose freight cars needed to transport lubricants.

3. Alternative Means of Transport for POL.

a. An assumption in this paper is that POL would have highest transport priority. Under this assumption, therefore, it appears that the total requirement would move by railroad and that all products would move by tank car except lubricants in all instances unless the movements were not economical. Nevertheless, alternative means of transport are available for some movements and it appears that in other instances packaging of products in addition to lubricants, particularly motor gasoline, might be found to be more economical than the exclusive use of tank cars.

b. Study of the individual movements described in Annex "A" reveals that the following alternative means of transport might be used:

(1) Column A can be supplied from Region IV via the Volga River as far as Moscow and thence by rail or via the Volga to Leningrad and thence by tanker to German ports on the Baltic. Packaging facilities might be established either at the refineries or at the Volga transshipment point. In either case the saving would be 168 tank cars.

(2) Column D can be supplied via Black Sea tankers and the Danube or by packaging either at the refineries or after traversing the Black Sea. Saving: 109 tank cars.

(3) It is not likely that the advantages of speedy bulk shipments in tank cars will be denied Columns B and C. However, the pipeline

from Armavir to Trudovaya may be used for the finished products to reduce the rail haul from Region IV.

(4) The Scandinavian Campaign could be supplied from Region IV via the Volga and thence to Norway, Sweden, and Denmark by tanker. Saving: 366 tank cars.

(5) The Italian, Greek, Middle Eastern, and Turkish Campaigns require a short haul of only 100 miles from Regions IV and V to the border points or ports. Some small quantities lend themselves to packaging for rail shipment and motor transport could move the remainder. Possible saving: 124 tank cars.

(6) The air force tank car requirement for Western Europe could be reduced in the same manner described for Column A and Column D of the ground force. Saving: 531 tank cars.

(7) The air force requirement for the Middle East and Turkish Campaigns amount to only 62 tank cars daily. In an emergency the air force in this area could supply itself.

(8) Movement of the Baltic and Arctic Naval requirements amount to 2,390 tank cars. While there is no possibility of packaging this requirement, it is possible that a considerable amount of it could move by water transport.

(9) The Zone of Interior ground and air forces need 9,700 tank cars for POL supply. However, where POL supplies are available close by and particularly within the regions it should be possible to reduce the dependence on rail transport through the use of organic transport of the military units. The use of such transport and other motor transport when available should serve to reduce the dependence on tank cars by at least a third.

c. Therefore, whereas it might be possible to reduce somewhat the over-all dependence on rail and tank car transportation for the shipment of POL supplies, there are certain POL shipments that would have to depend on rail tank car movement. These would be the shipment to the Far East, a large amount of the shipments to the Baltic and Arctic fleets, and certain high priority shipments for the ground and air force campaigns in Western Europe.

APPENDIX B (2)

AMOUNT OF POL IN TRANSIT

1. Total Amount of POL in Transit by Railroad.

The total amount of POL in transit at all times during the year in order to insure that supplies are available where and when needed will amount to 239,000 metric tons. A breakdown of the amount in transit by products is as follows:

Product	*Metric Tons*
Aviation Gasoline	65,000
Motor Gasoline	56,300
Jet Fuel	7,620
Diesel Fuel	27,180
Fuel Oil	72,000
Lubricants	10,900

2. Method Used in Estimating Amount in Transit.

The total number of annual ton miles was divided by the total annual number of tons requiring railroad transportation and an average length of haul of 1,540 miles was obtained. The average number of days per shipment was then secured by dividing the average length of haul by 186 car miles per car day which resulted in an average length of shipment of 8.28 days. By multiplying 8.28 days by the average daily shipment of 28,865 tons, a total of 239,000 tons in transit is indicated. This process was repeated for each of the products.

[p. 44 blank]

CHART I

ANNEX A

STATEMENT SHOWING ESTIMATED ANNUAL POL REQUIREMENTS OF EACH MILITARY CONSUMER, THE AMOUNT STOCKPILED AND THE AMOUNT THAT MUST BE TRANSPORTED
(Thousands of Metric Tons)

Military Consumer As Defined in JIG 278/6	Stockpiled						Requiring Transport					
	Gasoline	Diesel	Lubes	Av.Gas	Fuel Oil	Jet	Gasoline	Diesel	Lubes	Av.Gas	Fuel Oil	Jet
Column A	6.30	4.49	1.08				26.89	19.16	4.61			
Column B	105.45	67.24	17.27				120.77	77.01	19.78			
Column C	59.23	42.00	10.12				67.84	48.11	11.60			
Column D	15.44	13.57	2.90				17.68	15.54	3.32			
Scandinavian	20.60	10.76	3.13				65.81	34.36	10.02			
Italian D-Day	67.81	40.26	10.81				51.59	30.63	8.22			
Italian D ≠ 50	17.72	9.47	2.72				36.11	19.31	5.54			
Greek	85.60	48.86	13.45				93.09	53.13	14.62			
Middle East P	20.14	10.45	3.26				11.37	5.37	1.67			
Middle East Q	30.85	13.53	4.44				15.33	6.71	2.20			
Middle East R	3.47	1.64	0.51				8.13	3.83	1.20			
Middle East S	0.58	0.35	0.09				1.02	0.58	0.16			
Middle East Adm Trucks	—	—	—				192.01	—	19.20			
Turkey West	51.72	27.42	7.91				65.02	34.47	9.95			
Turkey Centre	22.37	10.48	3.28				26.57	12.45	3.90			
Turkey East	7.24	3.20	1.04				8.60	3.80	1.24			
Korean	7.69	3.67	1.13				26.53	12.66	3.92			
Chinese	47.96	26.87	7.48				67.55	37.84	10.54			
Air Force Western Europe)							149.60		12.40	382.00		112.60
Air Force Middle East)	77.70		5.90	206.60		28.90	58.90		4.80	146.10		47.10
Air Force Far East)							105.80		8.50	271.80		70.10
Naval Force Black Sea*							16.48	57.68	8.24		741.69	
Naval Force Baltic							18.62	65.17	9.31		837.94	
Naval Force Arctic							8.31	29.10	4.16		374.20	
Naval Force Pacific							23.95	83.81	11.97		1077.55	
Totals	649.87	334.26	96.52	206.60		28.90	1267.09	593.04	182.83	799.90	2289.69	229.80
Interior Ground-Air Forces**												
Region I							134.20	26.10	14.20	226.50		58.20
Region II							276.70	130.70	39.40	120.80		31.00
Region III							317.90	130.70	42.70	226.50		58.20
Region IV							124.90	61.00	18.00	45.30		11.60
Region V							154.20	61.00	20.40	120.80		31.00
Region VI							63.70	26.10	8.50	45.30		11.60
Region VII							317.90	130.70	42.70	226.50		58.20
Region VIII							63.70	26.10	8.50	45.30		11.60
Region IX							63.70	26.10	8.50	45.30		11.60
Region X							124.90	61.00	18.00	45.30		11.60
Region XI							148.40	61.00	19.90	105.70		27.20
Region XII							329.70	130.70	43.70	256.70		66.00
Totals							3386.99	1464.24	467.33	2309.90	2289.69	617.60

TOTALS STOCKPILED	1316.15
TOTALS RQRG TRANSPORT	10535.75
GRAND TOTAL***	12676.00

* Not included in totals requiring transport.
** Totals to nearest hundred tons
*** Includes Black Sea Fleet.

Sources of Information:
Requirements - Exterior Ground and Air Forces, based on JIG 278/6
- Breakdown of Naval Forces Requirements, Ad Hoc Petroleum Distribution Committee.
- Interior Ground - Air Forces, Joint Intelligence Group.

TOP SECRET

ANNEX A (Continued)

STATEMENT SHOWING ESTIMATED ANNUAL POL REQUIREMENTS OF EACH MILITARY CONSUMER, THE SOURCE OF SUPPLY BY ECONOMIC REGIONS AND THE TRANSPORTATION NEEDED

Consumers As Defined In JID 278/A	Gasoline: Thousands of Met. Tons RQMTS	Gasoline: Source	Gasoline: Miles	Gasoline: Ton - Miles	Diesel: Thousands of Met. Tons RQMTS	Diesel: Source	Diesel: Miles	Diesel: Ton - Miles	Lubes: RQMTS	Lubes: Source	Lubes: Miles	Lubes: Ton - Miles
...mem "A"	36.89	IV	2000	53,780,000	19.16	IV	2000	38,320,000	4.61	IV	2000	9,220,000
" "B"	120.77	IV	1600	193,232,000	77.01	IV	1600	123,216,000	19.78	IV	1600	31,648,000
" "C"	67.84	IV	1500	101,760,000	48.11	IV	1500	72,165,000	11.60	IV	1500	17,400,000
" "D"	17.68	IV	1500	26,520,000	15.54	IV	1500	23,310,000	3.32	IV	1500	4,980,000
...ndinavian	65.81	IV	2000	131,620,000	34.36	IV	2000	68,720,000	10.02	IV	2000	20,040,000
...lian D - Day	51.59	IV	100	5,159,000	30.63	IV	100	3,063,000	8.22	IV	100	822,000
" D + 90	36.11	IV	100	3,611,000	19.31	IV	100	1,931,000	5.54	IV	100	554,000
...ak	93.09	IV	100	9,309,000	53.13	IV	100	5,313,000	14.62	IV	100	1,462,000
...dle East "F"	11.37	V	100	1,137,000	5.37	V	100	537,000	1.67	V	100	167,000
" "G"	15.33	V	100	1,533,000	6.71	V	100	671,000	2.20	V	100	220,000
" "H"	8.13	V	100	813,000	3.83	V	100	383,000	1.20	V	100	120,000
" "J"	1.02	V	100	102,000	0.58	V	100	58,000	0.16	V	100	16,000
East Adm. Troops	192.01	V	100	19,201,000	—	—	—	—	19.20	V	100	1,920,000
...my "West"	65.02	V	100	6,502,000	34.47	V	100	3,447,000	9.95	V	100	995,000
"Centre"	26.57	V	100	2,657,000	12.45	V	100	1,245,000	3.90	V	100	390,000
"East"	8.60	V	100	860,000	3.80	V	100	380,000	1.24	V	100	124,000
...	26.53	VIII	5000	132,550,000	12.66	VIII	5000	63,300,000	3.92	VIII	5000	19,600,000
...	67.55	VIII	5000	337,750,000	37.84	VIII	5000	189,200,000	10.54	VIII	5000	52,700,000
Force Western Europe	149.60	IV	1050	157,080,000	—				12.40	IV	1050	13,020,000
" Middle East	58.90	V	135	7,951,500	—				4.80	V	135	648,000
" Far East	105.80	VIII	5000	529,000,000	—				8.50	VIII	5000	42,500,000
...Force Black Sea	16.48	IV	—	—	37.68	IV	—	—	8.24	IV	—	
...Force Baltic	18.52	VI	960	17,779,200	65.17	IV	1500	97,755,000	9.31	IV	1500	13,965,000
...Force Arctic	8.31	VI	1500	12,465,000	29.10	IV	2000	58,200,000	4.16	IV	2000	8,320,000
...Force Pacific	23.95	VIII	5000	119,750,000	83.81	VIII	5000	419,050,000	11.97	VIII	5000	59,850,000
Total, Ton-Miles or Tank Cars			(5)	1,972,317,700			(8)	1,170,264,000			(3)	300,681,700
[illegible] GROUND & AIR FORCES												
...ion I	34.20	VIII	975	33,345,000					14.20	VIII	975	13,845,000
	100.00	I	425	42,500,000	26.10	I	425	11,092,500				
...ion II	276.70	VI	960	265,632,000	130.70	VI	960	125,472,000	39.40	IV	2000	78,800,000
...ion III	100.00	III	320	32,000,000	100.00	III	320	32,000,000				
	227.90	IV	720	156,888,000	30.70	V	720	22,104,000	42.70	IV	720	30,744,000
...ion IV	124.90	IV	240	29,976,000	61.00	IV	240	14,640,000	18.00	IV	240	4,320,000
...ion V	154.20	V	240	37,008,000	61.00	V	240	14,640,000	20.40	V	240	4,896,000
...ion VI	63.70	VI	265	16,990,500	26.10	VI	265	6,916,500	8.50	VI	265	2,252,500
...ion VII	317.90	VII	300	95,370,000	130.70	VII	300	39,210,000				
									42.70	VI	500	21,350,000
...ion VIII	63.79	VIII	780	49,666,000	26.10	VIII	780	20,358,000	8.50	VIII	780	6,630,000
...ion IX	63.79	VIII	780	49,586,000	26.10	VIII	780	20,358,000	8.50	VIII	780	6,630,000
...ion X	124.90	I	720	89,928,000	61.00	I	720	43,920,000	18.00	I	720	12,960,000
...ion XI	148.40	I	2250	333,900,000	61.00	I	2250	137,250,000	[illegible]	I	2250	44,775,000
...ion XII	200.00	XII	360	72,000,000	100.00	XII	360	36,000,000				
	129.79	VIII	5000	648,900,000	30.70	VIII	5000	153,500,000	43.70	VIII	5000	218,500,000
- TOTAL, TON - MILES OR TANK CARS (5)				1,953,299,500			(8)	677,461,000			(5)	445,702,500
..., TON - MILES OR TANK CARS				3,925,017,200				1,847,725,000				746,383,500
... TANK CARS REQUIRED DAILY				6,990				3,375				1,363

Consumers As Defined In JID 278/A	Aviation Gas: RQMTS	Aviation Gas: Source	Aviation Gas: Miles	Aviation Gas: Ton - Miles	Fuel Oil: RQMTS	Fuel Oil: Source	Fuel Oil: Miles	Fuel Oil: Ton - Miles	Jet: RQMTS	Jet: Source	Jet: Miles	Jet: Ton - Miles	Total Tank Cars Required Daily
...mem "A"													[illegible]
" "B"													[illegible]
" "C"													[illegible]
" "D"													[illegible]
...ndinavian													[illegible]
...lian D - Day													
" D + 90													
...ak													
...dle East "F"													
" "G"													
" "H"													
" "J"													
East Adm. Troops													
...my "West"													
"Centre"													
"East"													
...													
...													
Force Western Europe	382.00	IV	1050	401,100,000									[illegible]
" Middle East	146.10	V	135	19,723,500					112.60	IV	1050	118,230,000	[illegible]
" Far East	58.90	VIII	5000	294,500,000					47.10	V	135	6,358,800	[illegible]
	183.00	I	5500	1,006,500,000					34.00	III	100	3,400,000	[illegible]
	29.90	V	7400	221,260,000					36.10	VIII	5000	180,500,000	[illegible]
...Force Black Sea					741.49	IV	—						
...Force Baltic					25.00	I	1000	25,000,000					
					812.94	VIII	1320	1,073,080,800					222
...Force Arctic					374.20	I	425	159,035,000					
...Force Pacific					300.00	III	360	108,000,000					43
					100.70	II	1380	138,000,000					762
					877.55	VIII	5000	3,387,750,000					
Total, Ton-Miles or Tank Cars			(8)	1,943,083,500			(8)	4,990,865,800			(8)	308,488,900	(8) 1868
[illegible] GROUND & AIR FORCES													
...ion I	226.50	VIII	975	220,837,500									
									58.20	I	425	24,735,000	60[illegible]
...ion II	120.30	VI	960	115,968,000					31.00	VI	960	29,760,000	98[illegible]
...ion III									56.20	III	320	18,624,000	775
	226.50	IV	720	163,080,000									
...ion IV	45.30	IV	240	10,872,000					11.60	IV	240	2,784,000	105
...ion V	120.80	V	240	28,992,000					31.00	V	240	7,440,000	16[illegible]
...ion VI	45.30	VI	265	12,004,500					11.60	VI	265	3,074,000	7[illegible]
...ion VII	85.00	VII	300	25,500,000					56.20	VII	300	27,660,000	433
	141.50	VI	500	70,750,000									
...ion VIII	45.30	VIII	780	35,334,000					11.60	VIII	300	3,480,000	199
...ion IX	45.30	VIII	780	35,334,000					11.60	VIII	780	9,044,000	209
...ion X	45.30	I	720	32,616,000					11.60	I	720	8,352,000	319
...ion XI	105.70	I	2250	237,825,000					27.20	I	2250	62,200,000	1405
...ion XII	149.40	VI	5790	1,434,050,000					66.00	XII	360	23,760,000	4430
	7.30	V	7400	54,020,000									
- TOTAL, TON - MILES OR TANK CARS (5)			(5)	2,477,183,000							(8)	209,727,000	(8) 9700
..., TON - MILES OR TANK CARS				4,420,266,500				4,990,865,800				518,205,500	28320
... TANK CARS REQUIRED DAILY				8,074				6,934				967	

... General-Purpose Freight Cars Required Daily

..., TON - MILES INCLUDING LUBES 16,249,963,500

..., TON - MILES EXCLUDING LUBES 15,502,580,000

..., TANK CARS REQUIRED, DAILY 28,320

..., General-Purpose Freight Cars Required, Daily 1,363

...ce of Information:

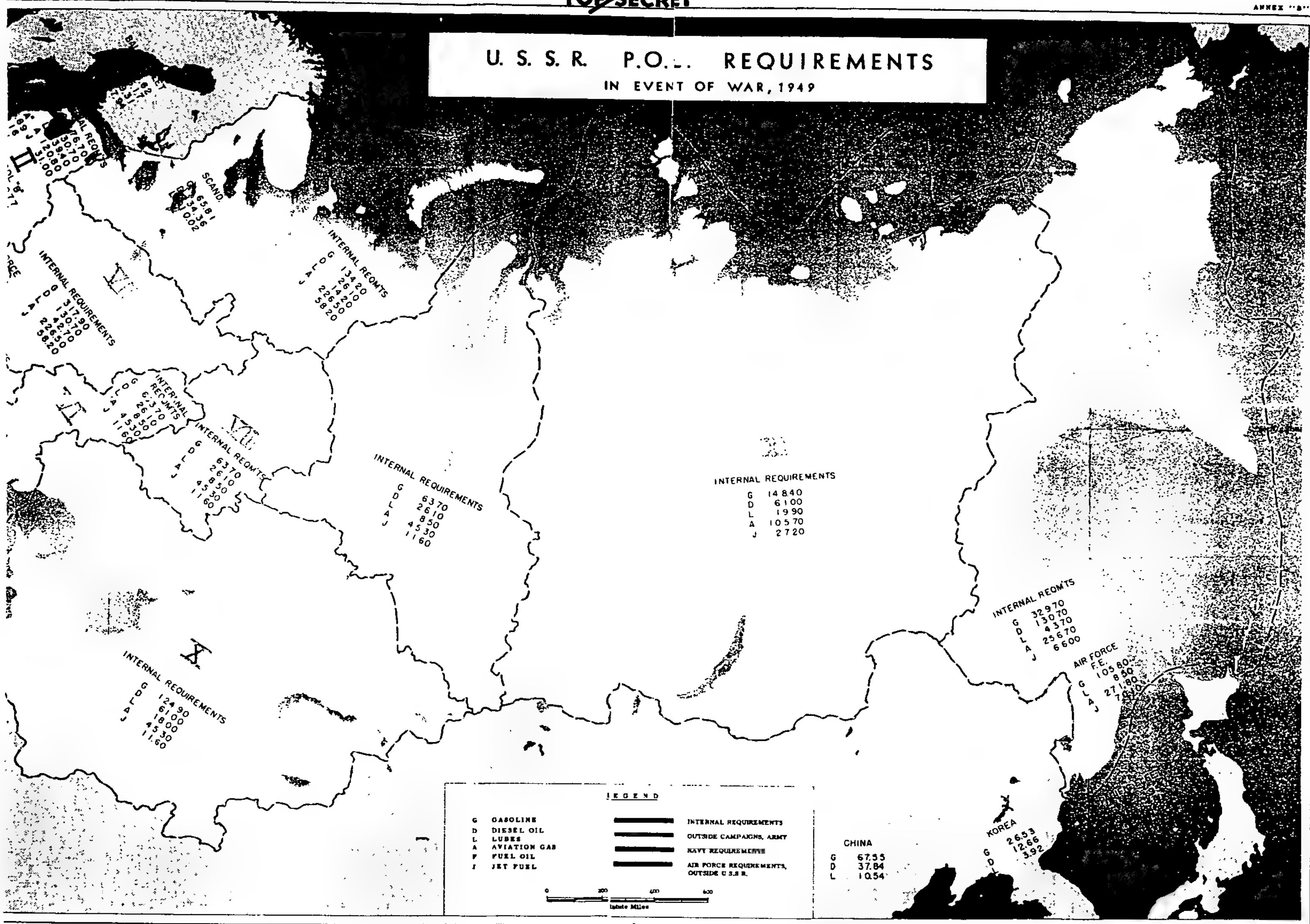
...urce of Supply by Economic Regions, CIA

...putations, Ad Hoc Petroleum Distribution Committee

TOP SECRET

TOP SECRET

ANNEX "B"



TOP SECRET

CIA MAY 1949

APPENDIX C

SOVIET CAPABILITIES TO EXPLOIT MIDDLE EAST OIL[1]

The most important aspect of the Middle East oil to the Soviet Union is the large potential of crude oil supply with a mid-1949 production of 35 million metric tons (1,400,000 b/d), and the availability of a mid-1949 refining capacity totalling 44 million metric tons (877,000 b/d). Included in the refining capacity is the potential of the Haifa refinery which is not being operated at present. The only refinery in the Middle East currently producing high-octane aviation gasoline is at Abadan, the largest refinery in the world. This refinery has an annual capacity of 25 million metric tons of petroleum products. The capacity and 1947 production of this refinery, of items of particular interest to the USSR, are shown below:

	(Millions of Metric Tons) *Annual Capacity*	*1947 Production*
Gasoline	3.00	1.60
Avgas	1.16	1.16
Avgas—100 octane	1.10	1.00
Blending agents	.40 (for 100 octane avgas prod.)	not known

Soviet additions to the Soviet Air Force of increasing numbers of bombers and jet planes have increased the requirements for high octane gasoline and jet fuel. Owing to the lack of highly specialized equipment needed in the production of high octane gasoline, the USSR will undoubtedly be confronted with a narrow bottleneck, particularly as a result of this shortage. Therefore, the acquisition of Middle East 100 octane aviation fuel, or the alkylate blending agents with which aviation fuel could be produced from USSR indigenous crude oil, would be of prime importance to the Soviets since it would satisfactorily supplement Soviet indigenous production and allow for the fulfillment of their wartime military requirements of combat aviation gasoline. Also, there is the possibility that the Soviets could transport to the USSR certain alkylation and catalytic cracking equipment at Abadan, with the object of improving their internal production of 100 octane gasoline and blending agents.

Another interest that would motivate Soviet acquisition of the Middle East area is that control of the Middle East would facilitate the freedom of movement of any forces that the Soviets might wish to employ in this area. This would give the Soviets an important base of operations and the availability of Middle East petroleum products would amply support their military operations in the area. It is recognized that under Soviet management the Middle East refineries and other facilities would not be run at their present efficiency. However, it is estimated that Soviet technicians would maintain a throughput volume of two-thirds of the current rate. In the absence of Allied countermeasures, this rate would amply suffice Soviet requirements in the Middle East.

If the Soviets cannot utilize the refining capacity of the Middle East, their primary objective would be to deny access of this important source of supply to the US. Soviet control or neutralization of this area would not only seriously curtail the petroleum supply of the US but would also drain the oil supply of the Western Hemisphere.

A significant limitation to any Soviet designs in the Middle East is the inadequacy of transportation facilities. In considering the difficulties facing the Soviets in trying to overcome the delivery of petroleum products, the question of production and refining capacity, however important, becomes secondary. It is estimated that the USSR could import from

[1] For a detailed treatment of this subject see J. I. G. 278/5.

the Middle East no more than 90,000 metric tons of oil per month or 1,095,000 metric tons per year. If land transportation facilities were continuously and exclusively employed in hauling oil, the theoretical capacity of rail and highway delivery from Iran and Iraq to Soviet border points and/or Caspian Sea ports is 1,825,000 metric tons per year. However, the probable practical limit of transportation capacity that would be attained under Soviet management is estimated at 1,095,000 metric tons per year. Assuming the theoretical maximum carrying capacity of the railroads and highways could be employed and maintained, the existing transportation facilities from the Middle East to the USSR would be sufficient to move only 8 percent of the present Persian Gulf refinery output.

Soviet efforts to gain optimum utilization of transportation facilities would be seriously handicapped. The railroads available are reported to be in poor condition, difficult to maintain, and could be easily knocked out of commission by air bombardment because of tunnels in the rail net. The transportation of petroleum products by highway would present the extremely difficult problems of long distances, mountain terrain, and poor roads. The Soviet Union could possibly attempt to build a pipeline in order to speed the flow of Middle East petroleum products to the USSR. However, the mountainous and difficult terrain would make the engineering problem extremely formidable. Experts who have studied the situation have estimated that even if such a pipeline could be constructed under the best possible conditions, a minimum of two years would be required before any benefit could accrue from it.

The difficulty of transporting Middle East petroleum products to the USSR can be minimized or could be completely overcome only if the Soviets directed an unwarranted amount of equipment, labor, and planning, to the project. Since the USSR is currently attempting and will continue to make an all-out effort to increase its indigenous oil production, the USSR could ill afford to transfer necessary technical experts to the Middle East. Therefore, the principal Soviet operations in the Middle East would probably be directed to transporting highly critical products such as aviation gasoline and other light fractions.

The Soviets could and undoubtedly would transport aviation gasoline or any highly critical petroleum products by air. It does not appear likely, however, that the Soviets would allocate all, or even a major portion, of their air transport reserve for the purpose of hauling Middle East oil products at the theoretical maximum of 75,000-90,000 tons per month. It is entirely unlikely that such a level of activity would be maintained. The required concentration of air transports needed for this operation would seriously affect Soviet transport capabilities in other theaters where reserve air transport might well be more profitably employed.

By utilizing all means of transportation, the theoretical capacity of the Soviets for transporting crude oil and/or petroleum products from the Middle East to the USSR is estimated to be from 10,200-10,700 metric tons per day, depending on the availability of four-engine transports. The probable practical limit in metric tons is estimated to be as follows:

	per day	*per month*
By land routes to Soviet border points and/or Caspian Sea ports	3,000	90,000
By 300 regularly assigned A/C	416	12,480
Total	3,416	102,480

Conclusion.

Even under favorable conditions extending over a period of one year, the amount of crude oil that could be transported practically from the Middle East to the USSR would be but a small fraction of current indigenous output of the USSR and would scarcely warrant the effort. On the other hand, the acquisition of Middle East 100 octane aviation fuel or alkylation polymerization and catalytic cracking equipment would be of prime importance to the Soviets since it would contribute materially to their war potential.

APPENDIX D

THE RELATIVE POSITION OF THE USSR PETROLEUM INDUSTRY

The petroleum output of the United States exceeds 200 million metric tons per year, whereas the Soviet Union has only recently managed to regain its 1940 level of 31 million metric tons per year.

The relative positions of the petroleum industry in the United States and the Soviet Union can be judged largely by production. For example, of approximately 9,200,000 barrels per day of liquid petroleum including light hydrocarbons currently produced in the world, exclusive of Russia and Baltic countries, about 6,000,000 barrels or about 65 percent are produced or can be produced within the confines of the United States. Further, of the 3,200,000 barrels of oil produced outside the United States, about 40 percent is produced by companies of US ownership or influence and most of the remainder produced in the world has become possible only by the use of US developed techniques and equipment. On the other hand, the Soviet production constitutes only 6.1 percent of the world's total.

The over-all refining plant of the United States is well balanced with respect to all products, whereas the USSR is deficient in equipment to make combat aviation gasoline.

Among the reasons for these divergencies are: (1) contrast in technical and industrial development in each country at the close of World War I; (2) different effects of the recent war upon each country; and (3) the great disparity in the levels of education and other basic factors relating to industrial production.

Further evidence of the unequal progress between the United States and the USSR is that US oil interests have developed the Venezuelan oil industry to a point where production in Venezuela is twice that of the Soviet Union. This achievement by US interests is exemplified by the fact that oil output in the Soviet Union and Venezuela was almost on the same level before World War II.

Much of the field and refinery equipment of the Soviet Union is out of date and, judged by modern standards, inefficient in operation. Also, the devastation of World War II has impeded both the necessary expansion of the industry and the maintenance and modernization of existing facilities and equipment. The Soviets are presently endeavoring to correct the deficiency in materials and equipment by expanding their manufacture at home. However, the supplies are slow in coming forward and are poor in quality and design.

The Soviets have also instituted expanding programs of exploration and drilling to make good the exhaustion of old fields and further increase crude oil output to a point where production will reach 60 million tons by 1960. Even under the assumption that the world production of petroleum will remain at the present level in 1960, Soviet crude oil production will constitute only 12.5 percent of the world total. If the past performance of the Soviet oil industry is used as a basis for comparison, the Soviets cannot be expected to make any spectacular improvements in the near future.

APPENDIX E

SOVIET CRUDE OIL REFINERIES

1. List of Crude Oil Refineries in the USSR.

(Capacities quoted in 1,000 metric tons per year)

ECONOMIC REGION: NORTHWEST

Plant Location	*Total Crude Throughput Capacity*	*Cracking Capacity*
Leningrad "Shaumann"	100	
Khotle Jarve	60	10
Riga	15	
Ukhta "Neft-Promisal"	250	
Total Northwest	425	10

ECONOMIC REGION: SOUTH

Drogobych		50
"Nafta"	60	
"Polmin"	160	
"Calicia"	140	
"Polskie"	40	
Mukacevo "Dal Karpati"	18	
Odessa	250 *	225
Total South	668	275

* Questionable.

ECONOMIC REGION: SOUTHEAST

Grozny	6,410	2,355
Krasnodar	500	
Makhach-Kala	50	
Tuapse	500	311
TOTAL SOUTHEAST	7,460	2,666

ECONOMIC REGION: TRANSCAUCASUS

Baku Waterfront Group	14,440	1,715
Baku Akmedy	100	
Batumi "Stalin" refinery, formerly "Asneft"	3,055	802
Tbilisi	20	
Total Transcaucasus	17,615	2,517

Plant Location	*Total Crude Throughput Capacity*	*Cracking Capacity*
ECONOMIC REGION: VOLGA		
Astrakhan	50	
Batraki	200	
Kuibyshev Lend-Lease #3	469	998
Kazan	160	
Saratov		2,011
Syzran	500	694
Total Volga	1,379	3,703

ECONOMIC REGION: CENTRAL INDUSTRIAL

Dzerzhinsk	150	
Gorki "26 Commissars of Baku"	600	
Konstantinovski	500	87
Moskva		
"Vladimirski"	500	
"Koshkin" (Neftegas #1)	520	388
Total Central Industrial	2,270	475

ECONOMIC REGION: URALS

Chkalov		1,000
Chusovio	120	
Ishimbayevo "Novy Peregonny" "Zavod"	485	
Krasnokamsk	200	
Orsk Lend-Lease #2	1,460	678
Sterlitimak	460	
Ufa	1,500	356
Total Urals	4,225	2,034

ECONOMIC REGION: WESTERN SIBERIA

Cheleken Island	160	
Chimion	130	

[p. 50 blank]

Plant Location	Total Crude Throughput Capacity	Cracking Capacity
Guryev	573	1,005
Kim "Komsomolets"	300	
Krasnovodsk	500	
Krasnovodsk Lend-Lease #4	521	1,042
Nebit Dag	250	109
Stalinabad	300	
Vannovskaya	500	
Total Western Siberia	3,234	2,156

ECONOMIC REGION: EASTERN SIBERIA

Plant Location	Total Crude Throughput Capacity	Cracking Capacity
Cheremkhovo	36	
Kemerovo	20	
Total Eastern Siberia	56	

ECONOMIC REGION: SOVIET FAR EAST

Plant Location	Total Crude Throughput Capacity	Cracking Capacity
Aleksandrovski	100	
Khabarovsk "Ordzhonikidze"	200	135
Komsomolsk	500	
Nikolayevsk	200	
Total Far East	1,000	135
Total USSR	38,332	13,971

2. Secondary Refinery List.
(Not Fully Confirmed)

ECONOMIC REGION: SOUTH

Plant Location	*Remarks*
Derezeytse	12,000 tons yearly throughput capacity (1938). SDS #2004, Mar. '41.
Hubieze	20,000 tons yearly throughput capacity (1938). Formerly known as "Hubicka Raffinerya Nafty." SDS #2004, Mar. '41.
Kherson	Stock for cracking plant is distillate from Tuapse and Grozny. World Oil Atlas gives cracking capacity as 225,000 tons yearly. Cracking plant reported moved to Syzran but may have been rebuilt and is carried as such. SDS #2028, 2562, 2025, 2317. Ltr., PAW to ONI, ONI 408-1000, 1944-45.
Mariupol	Benzol plant reported put into operation in 1946. "Krasnaya Zveszda", 29 Sept. '46.
Osipenko	200,000 tons yearly throughput, 180,000 tons cracking capacity. SDS #2317, 2004. CIA FDB, Source #2038.
Chalowka	Damaged refinery, 180 km E of Poltava. Reconstruction began in Mar. '45. USFA #70, 23 July '48.
Ordzhonikidze	Supplied by pipeline (35-40 cm dia.) from pumping station 10 km SE of plant. Five-million-liter capacity storage facilities. AF 234, Rpt #II-1019, 5 Apr. '49.

ECONOMIC REGION: SOUTHEAST

Plant Location	*Remarks*
Amavir	200,000 tons yearly throughput capacity. Plant reported under construction by several sources since 1941. This is likely since location is the terminus of pipeline from Tuapse and Grozny, continuing north tc other points. NA, London, Rpt #A-724-42, 22 Sept. '42. Wkly Intel. Rpt #159, 18 Sept. '42.

ECONOMIC REGION: TRANSCAUCASUS

Mirzaani	250,000 tons yearly throughput capacity. 150,000 tons yearly cracking capacity. Under expansion, completed in 1943 with modern cracking installation. SDS #2025, 552, 2002 (1944).

ECONOMIC REGION: URALS

Buguruslan	500,000-900,000 tons yearly throughput capacity planned in 1939, under construction in 1943. SDS #2002, (1944). ID 5879, 15 Aug. '47 (info dated Oct. '44). SDS #2578, 29 Apr. '43.
Molotov	800,000 tons yearly throughput capacity. Under construction since 1939 and continuing through 1947. Cracking plant presumed to have come from Osipenko. AF 156, Rpt #1083, 30 Mar. '49.
Kurgan	500,000 tons yearly throughput capacity. Topping plant planned. Started operation in 1945-46, aviation and motor fuel production.
Oktyabrsk	Refinery under construction. AAF 165, 7827/30, MIS 689 (4511) Jan '49. ECIC/23/304 (7869) July '48. ECIC/50/20 (2634), Oct. '48.

ECONOMIC REGION: CENTRAL ASIA

Novokazalinsk	Produces high-octane avgas. Administered by Soviet Air Ministry. USFA #73, 3 Sept. '48.
Andizhan	500,000 tons yearly throughput capacity. Production of naphtha at the plant is being increased. SDS #2028, 2317, Mar. '42. "Pravda Vostoka", 19 Oct. '46. Eco. Bulletin #31, 5 Aug. '48.

ECONOMIC REGION: FAR EAST

Sukhovskaya	Being constructed. WDGS Rpt #TB-871, #3008.

1950 MAY 5 15 08

~~TOP SECRET~~

~~CONFIDENTIAL~~